THE ILLUMINATING ENGINEER

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March, 1906--February, 1907

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GENERAL INDEX

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THE ILLUMINATING ENGINEER

Vol. VI

March, 1911--February, 1912

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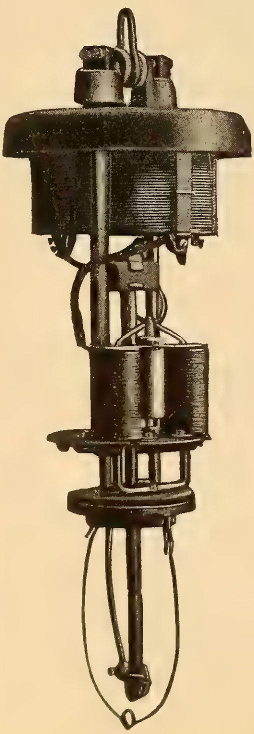

A full description is given on page 9 of our Circular No. 1102; the nearest district office will mail you a copy upon request.

Westinghouse Electric & Mfg. Co.

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The Business Side

If you believe that Business-Street Lighting is some of the Business Man's Business, you will be interested in the following clipping from the Syracuse (N. Y.) Herald:

"Considerable comment, expressing dissatisfaction or disappointment, has been heard concerning the new ornamental street lamps, in that the light provided by them is too much on the fire-fly order.

"Some of the merchants, when seen by a *Herald* man, expressed their feelings facetiously, but pointedly, nevertheless. 'From the talk I got,' said one of them, 'I expected that beautiful Syracuse would be lanes of light which would turn every street into a "Great White Way," bidding for another metropolitan feature for Syracuse; but when I looked down street last night, I thought it was a representation of the Milky Way, very much watered at that.'

"Arthur Dudley, commercial agent for the lighting company, who has charge of the street lighting plan, when questioned this morning, said, when it was remarked that there was considerable dissatisfaction with the lamps' illuminative power: 'This system is not a street lighting system, but ornamental in light effect. It originated in the West, and we are using the same power of lamp as they use out there. We could use large lamps, but the effect would not be as good. On each post the five lamps amount to 160 candle-power. The idea in this system is not to light the street—the street corner lights do that; it is to place in the globe a lamp which will just fill the globe and diffuse the light so that when you look down the street you get a pleasant boulevard effect through the rows of light.'"

This is typical of the experiences of business men wherever street lighting systems

OASES OF ILLUMINATION AMID DESERTS OF DARKNESS

There is hardly a city or town in this country which cannot boast of some park or "square" or some kind of "breathing space," centrally located and usually the centre of activity—oftentimes of business activity.

Such reservations are not always appreciated, especially at night, because of their dismal appearance. Yet, these are the very spots which should radiate good cheer and prosperity, both for the inspiration of the townspeople and visitors.

The above illustration is an instance of an installation of Luxolabra which has done wonders in not only illuminating the immediate locality, but has served to advertise the community very extensively. The Luxolabra have, besides, added to the tone and dignity of the entire neighborhood.

Wherever installed Luxolabra are always in place—whether in parks, along boulevards, or in shopping centres.

Put up a trial installation in front of your own office and watch it grow.

Write us your conditions—we can help you.

THE ADAMS-BAGNALL ELECTRIC COMPANY
CLEVELAND

New York Philadelphia Pittsburg Chicago Atlanta

The
Illuminating Engineer

Vol. VI MARCH, 1911 No. 1

ADVERTISING AND CIVILIZATION

Civilization definitely began when the savage first bartered the results of his skill or prowess for an equivalent possession of his fellow savage, and has ever since been measured by the extent to which such interchange has taken place.

It follows that every addition to the means of interchange of knowledge, or the product of the mind, and of commodities, or the product of labor, is a positive step in the advancement of civilization.

The greatest single agencies of civilization that have ever been produced in the world's history are the steam engine, which has made possible the interchange of commodities from every section of the world, as well as the promulgation of knowledge in printed form; and the telegraph and telephone, which have literally made all civilized humanity one community, in constant and almost instant communication with one another.

The invention of printing, great as is its value, would be of comparatively little use were it not for modern means of transportation. " Of making many books there is no end " was written thousands of years before the origin of the printing art; but of readers the number was few indeed, and the unread book is of no more value to man than the rags before they were made into the paper on which it is printed.

To-day we can say with equal truth " Of READING many books there is no end." Hence it is that the humblest laborer of to-day commonly possesses a wider knowledge than the kings and seers of olden times. Facts and ideas have been multiplied a million fold, and commodities serving man in a thousand different ways are made in a thousand different places.

The printing art enables thought to be fixed, and made transportable like merchandise; and so it has come to pass that every thought or idea, as well as the result of the labor of every workman in the world, is within reach of every inhabitant of the globe. This condition has created a new form of knowledge that is absolutely essential to the highest state of civilization, viz., a knowledge of WHERE the best idea, or fact, or commodity can be obtained.

The dissemination of this invaluable knowledge constitutes ADVERTISING.

There is a peculiar and erroneous opinion too frequently held that advertising is a sort of necessary evil attendant upon modern " commercialism "; whereas in fact advertising is the very life of commerce itself, and its importance as a promoter of civilization second to no single agency in existence.

It is surprising to find this illogical and pernicious idea of the fundamental purpose of advertising held by those whose position in our national government should entitle their opinions to respect and confidence.

Let us admit, simply for the sake of the argument, that the second-class postal rate does not cover the cost of the service. The amount donated by the government, even admitting its own figures, is less than that donated by the

advertisers. Even those entirely ignorant of the cost of producing a periodical must recognize the fact, from common knowledge, that the price paid by the consumer cannot possibly cover the actual cost of production. When you buy your newspaper for a penny, or the Sunday edition for a nickel, or your popular magazine for fifteen cents, you are only making a partial payment for value received; if the advertiser did not come in and make up the balance you would pay a far higher price, or do without. Who then is the chief supporter of this dissemination of knowledge which the government considers of such importance that it may justly be carried on at public expense? In this work of acknowledged value in the promotion of civilization, the advertiser is a copartner with the government; why then should he be especially singled out for burdensome taxation?

One of the most elementary principles in business is the fact that, in most cases, profit depends upon the volume of business transacted. Fixed charges normally do not increase in anything like a direct ratio to the increase in business. The statistics show that this law has held uniformly in the business of the Post-Office Department; the larger the amount of second-class matter, the less the nominal deficit has been.

Now, suppose a private corporation were confronted with a deficit; what method would it pursue in order to wipe out this deficit, or convert it into a profit? It would seek to do one or more of the following:

First: To reduce the cost of conducting the business without reducing its volume.

Second: To increase the volume without increasing the fixed charges.

Third: To increase the profitable lines, and decrease the unprofitable lines.

And what means would be used to bring about this increase? Unquestionably, ADVERTISING; as witness the telegraph and telephone business.

The Postal Department does not advertise, but enjoys the unique position of having an enormous campaign of advertising done for it. Every advertisement in a periodical which gives rise to a letter or a post parcel increases the profitable part of the postal service. Imagine, if you can, all periodical advertising to cease, and try to conceive what this would mean in the amount of private communication by mail.

Is it not a curious and anomalous position for the managers of a business to attempt to onerously tax those who are adding millions to its profits at their own expense?

Viewed either on the broad lines of civilization and humanity, or on the narrower lines of established business principles, or on the grounds of common justice and equity, the proposal to quadruple the rate on periodical advertising matter appears equally illogical and indefensible.

Every reader of this can exert a positive influence for the prevention of this unjust and unbusinesslike proposition by filing his protest with a member of Congress, who is bound to respect his opinion.

The proposed increase in rate is limited in such a way as not to affect this particular publication, and we, therefore, can speak on the broad grounds of public good, uninfluenced by any conditions of personal loss or aggrandizement. Right and justice are no respecter of persons, and civilization advances on the principle of the greatest good to the greatest number.

We appeal this time for "More and Better Light" on the great work which legitimate advertising is doing for the advancement of civilization.

E. L. Elliott.

A Year's Progress in Illuminating Engineering

A Record of Unbroken Substantial Advancement in Every Part of the Field

By E. Leavenworth Elliott.

Five years have passed since The Illuminating Engineer made its first bow to the public, and actively began its campaign for "More and Better Light." Looking back over this brief span of time, the changes that have taken place in the production and use of artificial light would seem incredible were we not reminded by other evidences of the phenomenal progress in the general field of science. At the close of each of these years we have taken occasion to review the progress of the preceding year, and on each occasion we have had the pleasure and satisfaction of noting extensive and important forward movements.

In looking over the last of these years now brought to a close in our own division of time, the progress seems to have proceeded in a geometrical ratio, the cumulative results of all the preceding years having increased by the same multiple. The field in which the greatest progress has been made is in the methods of using light and the general interest manifested in illuminating engineering, rather than in the means of light production. A careful and judicious weighing of all the evidence obtainable justifies the statement that the past year has witnessed a greater increase in the thoughful consideration of the subject of illumination on the part of users of light, which represents the general public, than has taken place in any preceding year. While it has been gratifying to record from time to time the recognition of illuminating engineering as a distinct branch of science and a separate profession by those whose financial interests are directly concerned, it is a still higher satisfaction to record the awakening of interest in the subject by the public, which is the ultimate beneficiary of the science and profession.

The Lecture Course in Illuminating Engineering at Johns Hopkins University.

While there are many minor evidences of the increasing recognition of illuminating engineering, the most prominent event during the past year in the progress of the science was the lecture course conducted at Johns Hopkins University, Baltimore, Md., under the joint auspices of the Illuminating Engineering Society and the University. The personnel of the staff of lecturers and the purpose and scope of the course have been previously discussed in detail. While the subject matter of the various lectures will constitute a compendium of illuminating engineering which will serve as a standard until the progress of the science renders its revision necessary, the very fact that there is such a standard work, and that the oldest of American educational institutions established on the university plan is joint sponsor for this work, establishes illuminating engineering as a science and profession as indisputably as did the acceptance of our ambassador at the Court of St. James establish American independence.

The question, "What is an illuminating engineer?" which was so often heard during the preceding years, and of which some echoes were still faintly audible at the Baltimore convention, must henceforth be an evidence of ignorance on the part of the questioner rather than an inference of unreality of the thing in question. There is no longer any attempt made to avoid or paraphrase the term; even the architectural profession, acknowledged the most conservative and aristocratic of all the scientific professions, has accepted the inevitable and acknowledged

the claims of illuminating engineering as a special branch of applied science. This recognition on the part of the oldest of the scientific professions naturally carries with it an appreciation of the difference in ages and the consequent fact that illuminating engineering has yet much to learn; but no sincere illuminating engineer will deny this assumption nor be in the least discouraged in his efforts toward perfecting the science on this account.

With the final seal of approval set upon its work and aims the profession of illuminating engineering, and the society which represents it, is now free to work out its destiny as fully and as rapidly as its own personal efforts will permit.

The Illuminating Engineering Society.

Whether or not it does in actual fact represent the progress and spirit of the science and profession of illuminating engineering, the Illuminating Engineering Society must take the responsibility of such representation in the eyes of the other professions, and the public; and it behooves every one who claims the title of the profession, or who is seriously interested in its welfare, to do all within his power to see that the society represents the highest ideals and practice in the science.

The past year has seen a fifty per cent. increase in the society's membership. While this is circumstantial evidence of progress it is not of itself an absolute proof. While the right of illuminating engineering to exist was still questioned mere numbers espousing the cause was of material benefit, but now that the cause is fully established the accumulation of such evidence no longer serves its purpose, and the society henceforth must be judged by the actual work which it accomplishes in promoting the science and art of illumination. The kindergarten and elementary work has been done. Those who are making their initial efforts at acquiring the requisite knowledge to qualify them as illuminating engineers have plenty of sources from which to secure the necessary data and information. The society henceforth must be a university rather than a preparatory school, and its success be judged by the extent to which it pushes forward practical and theoretical knowledge of the subject, rather than the number of beginners which it can enroll.

While its material progress has thus been satisfactory during the past year, the fact disclosed by the last report of the secretary, that of its total membership but one per cent. is among the architects, shows that there is still much to be done in forwarding the use of the science in the field in which it can be most useful. To speak plainly, quality of membership, and of papers and lectures is now a much more vital question than quantity. One hundred and fifty members, actively engaged in either the theoretical or practical branches of the profession and sincerely working for its betterment and contributing their best to the proceedings of the society, might easily accomplish more for the genuine progress of the science and its use by the public than 1500 members who were merely "interested."

The society's record during the past year is one of which its administration, headed by Dr. Hyde, have every possible reason to be proud; the increase in membership, and the very successful convention and lecture course have brought to a glorious completion the first period of the society's career. The progress henceforth must of necessity be less spectacular, but need not be less real and important.

The election of Professor Kennelly to the presidency is in every way satisfactory, and a cheering evidence that the members of the nominating committee, as well as of the society at large, recognize the course along which future growth is to be expected. Professor Kennelly is a scientist whose entire life has been devoted to the promotion of science for its own sake, free from any restraint or bias of commercialism, and is therefore peculiarly well fitted to lead the society along similar paths. There is every reason to hope and expect, therefore, that as the work of the society in the past has been phenomenally successful in the directions which were most advantageous under existing conditions, so likewise will be its progress in the future.

The Movement for the Conservation of Vision.

The "Conservation of Vision" is today as new and vague a phrase as illumi-

nating engineering was five years ago, but its import is no less important to the general public. Briefly stated, the conservation of vision movement is the culmination of a number of separate efforts which sprung up simultaneously in different fields, having the same general purpose of protecting and conserving the organs of vision. Illuminating engineering came into existence as the result of scientific and professional study and observation on the physical side of illumination. It originated from economic motives. The gross and needless waste of illuminants in producing illumination attracted the attention of those who were dealing with other scientific problems, and resulted in a study of the subject on engineering lines, for engineering is fundamentally a question of scientific economics. The engineer is always face to face with the problem of how to accomplish a material result with the least possible outlay of material and labor.

On the other hand, the fact that a very considerable portion of the total blindness in existence was due to preventable causes set those who deal with the physiological side of vision, and others who were interested purely from the humanitarian side, to thinking upon the question of the value of vision and its proper conservation. From this it was but a short step to investigating all conditions which would injuriously affect the eye-sight. Observation of the innumerable cases of illumination that are positively unhygienic and deleterious, and a realization of the importance of bettering such conditions, followed as a matter of course.

The interest thus aroused in the subject of lighting entirely from the physiological standpoint, and as affecting the user of light, became sufficiently pronounced and co-ordinated during the year as to result in definite action, which has resulted in what is aptly called the conservation of vision movement, and which will have a local habitation, as well as a name, in the proposed Association for the Conservation of Vision, the organization of which is imminent. This movement will enlist a class of professional men whose co-operation is as essential to the complete realization of all the benefits of artificial light as is the physicist and engineer, viz., the oculists and physicians. This crystallization of the demand for better lighting on the part of users is unquestionably the most important single event in the general field of lighting during the past year.

The development of illuminating engineering as a science and art is in itself of comparatively little value, the real measure of its value depending upon the extent to which use is made of its principles. The movement for the conservation of vision might be fairly defined as an effort to test out the theories and principles of illuminating engineering by their actual results upon the eyes, and to promote the use of those which are found to most fully satisfy all requirements. The physical side of the problem of illumination has now advanced far beyond the physiological side. The illuminating engineer can determine with great accuracy all the physical requirements for producing an illumination having given physical characteristics, with the minimum of expense. What the effect of the various physical characteristics of illumination are upon the organs of vision directly, and upon the general physical and mental health indirectly, however, is a field which is almost entirely unexplored, and which offers a variety and extent of research only equalled by the importance of the results to be obtained. The exploration of this enormously important territory is the specific province of the conservation of vision movement.

Besides the committees who are working exclusively on the methods of preventing blindness, there are at present in existence a committee working on the subject of the conservation of vision of students and pupils of the public schools; of the prevention of injuries to the eyes by accidents from all causes, and the subject of industrial lighting as affecting the eyes and general welfare of working men and women. Legislation on the subject of illumination, both in industrial and educational establishments, will sooner or later result from the work of these committees and the new Association for the Conservation of Vision.

Illuminating Engineering and the Fixture Trade.

The importance of the attitude of those engaged in the manufacture and sale of

lighting fixtures toward illuminating engineering is due chiefly to the fact that, before the establishment of illuminating engineering, the lighting of a building was very frequently put entirely in the hands of the fixture maker or dealer by the architect; hence the responsibility for the illumination obtained rested primarily upon the fixture maker.

Without exception the fixture trade opposed illuminating engineering at the outset; it could see in the movement only a possibility of interference with the business to its financial detriment. The "vested interests" are always opposed to any kind of change, preferring to endure the ills they have, no matter how serious or of how long standing, than to fly to others that they know not of.

It is common knowledge among all those in any way connected with the fixture business that it has been for years, and is to-day in a most precarious condition. It is even stated by those who are in a position to know, that if the entire fixture business of the country were forced to liquidate to-day it would not realize 50 cents on the dollar; while the concerns and individuals that have started in the business, followed an unstable career for a short time, and then dropped out of existence, can be numbered by the score. And yet, in the face of these conditions, which to the outsider would seem so hopeless as to make any kind of a change welcome, the fixture interests were at first a unit in their opposition to illuminating engineering, and even to-day are only beginning to recognize in this movement the means of extricating themselves from the "slough of despond" in which they have for years been wallowing. Even the example of a newcomer into the business that made an unqualified financial success on a purely illuminating engineering basis was not sufficient to convince the established trade of the error of its ways.

The past year has seen some definite progress toward a change for the better in this anomalous condition of the business. The organization of the fixture manufacturers, which we have urged for the past five years, has taken definite shape. While this organization yet lacks the power and influence which can result only from practical unanimity of support and action, it is the longest step toward a rehabilitation of this important industry that has been yet taken. When the trade as a whole learns to conserve its energies by co-operation rather than expending them in useless and destructive mutual warfare, the business will be put upon a higher plane, and illuminating engineering will be welcomed as a most valuable ally instead of being shunned as a suspicious character.

The great majority of lighting installations in use to-day are more or less antiquated. Improvements in the methods of producing and using light have rendered the installation of ten years ago, or even less, obsolete. This means that there are thousands of fixtures in use to-day that properly belong in the scrap heap. The one thing that will put them where they belong is the education of the user to the fact that he is wasting his money, abusing his eyes, and sinning against his appreciation of the beautiful at the same time. In other words, it is illuminating engineering on broad lines; and yet this enormous field of possibilities for trade has thus far entirely escaped the notice of those most interested, viz., the fixture manufacturers. They have been entirely too busy with cutting one another's throats in the matter of price in order to secure the new installations on an unprofitable basis to have time to cultivate this neglected field.

A movement toward organization, and a more respectful attitude toward illuminating engineering, with even some cases of actual acceptance of its assistance, are encouraging signs for the future.

Illuminating Glassware.

The greatly increased activity in the production of new forms of illuminating glassware, which was noted in our review a year ago, has continued unabated during the year just passed. All of the leading manufacturers now furnish photometric data on all new forms put out, and give as full information as possible on illuminating engineering lines in their commercial literature.

Of the many new forms of illuminating glassware, Alba glass has attracted the widest attention. This would naturally

result from the fact that it is the only distinctly new type of glass that has appeared in America for many years. Glass of this type offers great possibilities for entirely new and highly decorative and efficient systems of illumination. To the illuminating engineer who has constructive imagination and the artistic instinct it offers endless possibilities for the exercise of his genius. Fortunately also, the manufacturers are unusually liberal in their experimental work, being willing to assist to any reasonable extent any engineer whose schemes are promising.

While many different makes of reflectors using some combination or quality of opal glass have appeared, there is a noticeable lack of originality in design. Since the illuminating results are not greatly affected by the shape or contour of reflectors or globes of this type, there is a wide opportunity for variation and originality.

Prismatic glassware, which is undoubtedly largely responsible for the general awakening of interest in the manufacture of illuminating glassware, is holding its own for commercial use, but as yet has made very little headway in installations in which artistic effect is of prime importance. The very fact that this form of glassware has become so generally used commercially is likely to retard its use for more artistic installations by mere association of ideas.

The most notable fact in the illuminating glassware situation is the careful consideration now given to this important accessory. The time when "globes and shades" were turned out at the glass factories merely as pieces of glass, to be sold indiscriminately for what they would bring, like so many pots and kettles, is nearly past. Illuminating engineering has shown the enormous importance of this element in the problem, and, by educating the user, has compelled the manufacturer to conduct his work on a much higher plane, greatly to his own advantage.

The makers of illuminating glassware have had an exceptionally prosperous year, the common complaint being inability to fill orders, even with increased facilities. All indications point to a continuation of this excellent condition of progress and prosperity.

The Renaissance of Gas Lighting.

We have on more than one occasion remonstrated with the gas interests of this country for their lack of enterprise and progress in keeping gas illumination in the position which its merits deserve. We predicted a year ago that the progress of illuminating engineering in this particular field would be marked during the coming year, and we are happy to record the fulfillment of this prophesy. It is not overstating the situation to say that there has been more genuine progress in gas illumination in this country during the past year than in the four years preceding. This does not mean that the results measured in dollars and cents have increased to this extent, but that real interest and activity among the gas companies and the manufacturers of gas lighting apparatus have thus progressed.

The Illuminating Engineering Laboratories of the Welsbach Company is now closing its second year, and its work has been second to no similar department connected with any concern or industry. The number of actual installations that have been carefully engineered runs into the hundreds, and the possibilities of illuminating engineering in the furtherance of gas illumination has made most substantial headway.

Four years ago it was not uncommon to hear the statement seriously made that illuminating engineering did not apply to gas; to-day such a statement would be passed over as too absurd for notice. For the first time in our history there is now one of the finest office buildings in the country lighted throughout with gas, although the tenant may use electric light if he prefers. This is the magnificent new building of the People's Gas Light & Coke Company, of Chicago. It is hard to say whether the feeling of gratification or chagrin predominates when the visitor, on seeing the beautifully illuminated halls and offices, almost invariably passes some facetious remark on the gas company lighting its building with electricity. That illuminating effects of the highest quality can be produced by gas is certainly cause for gratification; but that the layman assumes that such effects can be obtained only by electricity must certainly detract much from this feeling.

While it is not at all probable that there will be any decided reversion to gas lighting in office buildings, the fact is nevertheless most significant that such buildings can be illuminated with complete satisfaction by the use of modern gas lamps, utilized in accordance with the best illuminating engineering practice. The Gas Show in Boston, held in connection with the National Commercial Gas Association Convention, was also a convincing demonstration of the possibilities of modern gas illumination.

The work of rehabilitating gas light is bound to proceed with increased vigor during the coming year.

The Architect and Illuminating Engineer.

The attitude of the architectural profession toward illuminating engineering is not to be judged by its representation in the membership of the Illuminating Engineering Society, as previously noted. It is a well known fact that the architect more jealously guards his profession from any intimations of commercial influence than any other practitioner, not even excepting the physician. This is doubtless partly due to the very prominent position which architecture has always taken in representing the art and civilization of a nation; and, in modern times, at least, to the innumerable opportunities which present themselves to the practicing architect for unholy alliances with the various concerns furnishing material. The great preponderance of members in the society connected with some of the commercial lighting interests is a matter of record, and as we have frequently pointed out, the inevitable result of wholly natural conditions, since it was these interests that stood most in need of the services of the illuminating engineer. It is undoubtedly this condition of affairs which has restrained the architects from joining the society. That the profession at large, however, is giving constantly greater recognition to illuminating engineering as a special branch of science there can be no doubt.

The formation of an Illumination Club in a Western city, which was evidently promoted by architects, as previously noted in our columns, is particularly significant. The engineering of some especially notable lighting installations is also worthy of mention, among which are the Soldiers Memorial at Pittsburgh, the buildings for the Department of Education of the State of New York at Albany, and the office buildings for the two branches of Congress in Washington.

Illuminating engineering represents scientific progress and is as sure to ultimately come into general use by every one connected with the planning or equipment of buildings as electric traction to succeed the horse car. Considering his natural conservatism, the architect is accepting illuminating engineering quite as rapidly as could be expected—perhaps even as rapidly as the increase in number of competent illuminating engineers.

The New Public Lighting.

By this term we refer to the modern installations of street and park lighting which are variously spoken of as "decorative," "spectacular," or "White Way" systems. The continued spread of this movement, which we predicted a year ago, has more than lived up to our predictions. We have recorded installations in every section of the country, and from cities of the first magnitude, like Chicago and Philadelphia, down to the country village of 600 inhabitants. The movement is still generally fostered by private interests through local, civic and business associations. Many of the earlier installations have been largely extended during the year, which is proof positive that the results from the business standpoint fully justify the claims that have been made for good public lighting as a municipal asset. Not a single instance has come to our attention where an installation has been discontinued, or any disappointment expressed as to its value.

In a number of the older installations in the larger cities efforts have been made to shift the maintenance cost to the city at large. This is the logical sequence of events, and must ultimately take place in all cases where public lighting has been installed and maintained by private subscription. The number of cases of new lighting installations put in and maintained as a part of the general lighting system has materially increased during the

year, Philadelphia being the most notable example.

Gas illumination, which has figured conspicuously in this kind of lighting abroad, has made a small beginning in this country during the year, but not enough has been done in this direction to make the results generally felt. What position gas light will take for this purpose in the future remains to be seen, but present evidences do not justify the prediction of any appreciable change in the present monopoly of electric light in this field, at least in the immediate future. The reasons for this are too involved to admit of analysis in this review. The regeneration of public lighting, however, will surely proceed with undiminished vigor for some years to come; the need for it is sufficiently pressing and the field sufficiently attractive to the purveyors of illuminants and apparatus to insure its rapid exploitation.

Progress in the Production of Illuminants.

The production and distribution of electricity by public corporations has proceeded at a very satisfactory pace. The agitation for municipal ownership of lighting plants which gave some concern to the central station industry a few years ago has almost entirely subsided. The exercise of a certain amount of regulation and supervision by state commissions has been accepted as the better solution of the problem, and experience has shown that honest capital has nothing to fear from such regulation. "The-public-be-pleased" policy is being generally put into use, partly through fear of drastic legislation, and partly through a recognition of the fact, exemplified in many prominent cases, that it is the only policy which can produce the highest commercial prosperity. Cheap rates are but one of the means, and perhaps not even the most important, of securing general public approval, good service being at least an equally important item. Good service is far more than a mere prompt and courteous attention to complaints; it means *bona fide* assistance to customers in securing the best possible results in illumination for their purpose. This is simply the application of illuminating engineering in its broad sense; and whether they call it by that name or not, there can be no question that the central stations are making constantly greater use of its purpose. Generally, however, it is freely used by its proper designation, and full advantage taken of the advertising value of the fact.

The remarkable growth of the National Electric Light Association, which now has a membership well over 6000, and whose activities have been enormously enhanced by the establishment of local sections, must be exceedingly gratifying to all those interested in this gigantic industry. Co-operation, especially among those widely separated geographically and working under different local conditions, must inevitably result in the suppression of small prejudices and narrow methods of dealing, and the growth of more far-sighted and broad principles of business. The action of the association in attempting to have unnecessarily burdensome restrictions lifted from the use of water powers is commendable, and in the line of true progress.

It is probable that there is no other line of business in the country that has maintained so staple a financial equilibrium during the vicissitudes of the past quarter of a century as the production and distribution of electric current. The industry now represents in its various ramifications an investment of $2,000,000,000, and it is safe to say that this is only a fair beginning of what the industry will ultimately represent.

The gas industry, while less in the public eye, has made equally satisfactory progress; and in spite of the more spectacular evidence of increase in the use of electric light, the increase in the use of gas for illumination has proceeded at its usual rate.

Meanwhile, the candle-makers and the refiners of petroleum have continued to prosper and increase their business, while the acetylene industry has by no means been "marking time," but continuing its steady march of progress.

The "Blaugas" process, which created considerable interest when first announced to the public, is being tried out in a small way by a collection of capitalists, its activities thus far having been confined to Long Island. Should the results meet the

hopes and expectations of those interested there will be no lack of financial backing to promote its use in its legitimate field.

The prediction sometimes made that some one particular luminant is about to displace some one or all of the others will be seen to be entirely groundless. A new luminant or apparatus of producing light does not supersede, but simply adds to, the general means of securing illumination. Every one of the luminants at present in commercial use, including the candle and oil lamp, which date back to prehistoric times, down to the most recent discoveries have found a place in the limitless field of illumination, and are working out their own destiny in accordance with the universal laws of trade and commerce.

Electric Lamps.

While no distinctly new form of electric lamp has appeared during the year, even in the experimental stage, there has been marked progress in the development of the newer forms of both incandescent and arc types. The tungsten lamp has undoubtedly reached the last stage in its physical development in the use of the drawn wire filament. Lamps of this construction have been regularly placed on sale within the present month. This improvement will reduce the mechanical breakage in shipment, and give to the lamp the same general uniformity in performance as is secured in the perfected carbon lamp. It is difficult to see how any very substantial improvement can be further made in metallic filament lamps. Future progress in this case will be in the line of reduction of cost resulting from improved and standardized methods of manufacture.

The old familiar carbon lamp has not stood entirely still, but has received some refinements in manufacture which make it feasible to use it at somewhat higher efficiencies.

Commercially, the year has been a most successful one among the manufacturers. Greatly increased factory facilities and research equipment have been completed or are now in progress. Profits have been satisfactory, while prices to the consumer have been reduced.

Among arc lamps the flaming arc has been foremost in point of improvement. This type of lamp, which is the most efficient electric light producer in commercial use, has been limited in its application by its short burning hours. Attempts to overcome this one handicap have been made in three different directions: by magazine carbon holders automatically operated, by enlarged carbons, and by inclosing the arc. The first of these methods has never been seriously considered in this country; the second is being tried out, but is of doubtful utility; the third method holds out great promise of a fully satisfactory solution of the problem, several different makes of this type now being on the market. The long burning flaming arc lamp is sure to come in the immediate future, if in fact it is not already with us; and when this condition arrives it seems probable that all other forms of arc lamps will gradually succumb to the law of the "survival of the fittest." The flaming arc has as yet made little headway in this country for public lighting, owing to its short life. With this handicap removed this enormous field will be open to its use.

The "magnetite," "metallic," or "luminous" arc, as it is variously called, has made marked progress commercially, a number of large installations in first-class cities now being in regular service. It must be admitted, however, that at least from the physiological standpoint, the results are disappointing owing to the excessive glare produced. The mistake has been generally made of using clear globes, which accentuate this fault. As the magnetite lamp is in efficiency about midway between the inclosed carbon and the flaming arc, it is evident that it cannot compete with the latter type when it loses the advantage of longer life.

The Cooper Hewitt lamp has made very decided progress in the extension of its use. Its manufacturers have purchased and equipped a new manufacturing plant which will triple their capacity, and have extended their selling organization. The real merits of this remarkable lamp, which have been obscured on account of the popular prejudice against its color, are now beginning to be more generally understood, and with this understanding has come a larger use of the lamp for the particular fields for which its peculiar merits

especially fit it. The astounding claim that it is "better than daylight" has been actually proven in many instances, and affords an impressive example of the increasing mastery of science over nature.

The quartz mercury vapor lamp has not yet made its commercial appearance, although it is said that the manufacturers of the Cooper Hewitt lamp have secured the American rights in the patents, and will place the lamp on the American market as soon as it can be manufactured on a commercial scale. From all reports much is to be expected from this type of lamp, both in the way of efficiency and quality of light.

The Nernst lamp appears to have been following "Bre'r Rabbit's" tactics of "lyin' low," a policy which is not necessarily opposed to successful commercialism. While but little has been heard of the lamp, its manufacturers claim to be quite satisfied with the year's work. The most notable installation of this type of lamp during the year is that of the new Pennsylvania Terminal in New York City.

The Moore Vacuum Tube light seems to have at last found its niche in the great field of illumination. The carbon dioxide tube is beyond all doubt or peradventure a producer of absolutely white light, and in this respect has not even a near-competitor in the field. It is now being prepared in comparatively small, portable units, which adapts it to use in almost any position. The Western Electric Company has taken up the sale of this form of the Moore light, which gives it the commercial advantage and prestige of one of the largest selling organizations in the country. This form of light is now used by dye works and other concerns for color-matching in preference to daylight—another instance where science has beaten nature at her own game.

Gas Lamps.

The adaptation of the inverted burner to the multiple, or so-called "gas arc" lamp, has been the only innovation during the year. This has been successfully accomplished both for indoor and outdoor types, and gives to this form of lamp the advantages of longer life of mantles, better natural distribution of rays, and slightly greater efficiency that are characteristic of the inverted burner. Systems of electric ignition have been exhibited which are exceedingly promising, and it is probable that they will be commercially available during the coming year.

The so-called "artificial silk mantle" has been worked upon and astonishing results in maintained candle-power and life obtained. The commercial advent of this improvement, which was expected during the past year, is confidently looked for during the present season. When it is remembered that gas mantles must be made by the million to supply the demand for a marked improvement, it will be realized that something more than mere laboratory success is necessary before such a mantle can be offered to the public.

Much public attention has been attracted by the so-called "Amber" light mantle, which has been especially exploited by one of the largest gas companies. This is noteworthy in view of the claims of the advantage of white light that were first advanced by the makers of the metallic filament lamps, and shows how various are the requirements in the general field of illumination. The merits of light of this quality for residence illumination are undoubtedly worthy of serious attention.

Retrospect and Forecast.

Altogether the year past has witnessed positive and marked progress in every branch of the lighting industry and every phase of the use of illumination. There have been no spectacular discoveries or inventions, but decided improvements in most of the different types of lighting units. The field of choice of different light-sources and accessories has widened and become better understood. The whole subject of illumination has received decidedly greater and more intelligent attention.

As great as are the improvements already made, we are still so far from reaching perfection that the first step has hardly been taken. But life itself is simply progress; and when we have reached perfection, either in physical science or in moral attributes, we may well look for the universal cataclysm which will usher in a new heaven and a new earth.

Progress in Electric Lighting During the Year 1910

By G. Brewer Griffin.

What particularly impresses the observer who is in position to know what has been done in the way of improved street lighting in the United States during the year 1910 is the widespread adoption of two forms of street illumination.

The first form is represented by metallic flame arc lamps, using electrodes of metallic substances which have long life and low wattage consumption for the luminous output, giving greatly improved efficiency in operation and light production over previous forms of street arc lamps. The most common and apparently thoroughly satisfactory lamp of this character has been based on 4 to 4½ ampere consumption. When lamps of this nature were first put on the market by the two principal manufacturers the life per trim, stated to be 175 hours, was looked upon as a great advance in this respect over the carbon type lamp. To-day it is not uncommon to find that improved electrodes have made it possible for such lamps to operate 225 hours and upward per trim.

A great deal of attention has been given to the proper diffusion of the light produced by this form of arc and to the methods by which the by-products of combustion can be taken from the lamp by air-draft principles which tend to give approximately the same light efficiency at the completion of the electrode consumption as was had at the beginning. It was found in the early development that if the proper draft principle was not applied to the lamp a thin coating of mostly iron oxide having a yellowish-brown color was deposited on the glass, so that after 100 hours' operation considerably less light was obtained from the lamp owing to the semi-opaque character of such deposits. This trouble, I might say, has been obviated in the lamp now offered to the public.

One of the prominent manufacturers has made very great advances in the character of the electrodes supplied and will shortly be in position to supply "squirted" electrodes, giving extreme life with a minimum amount of by-products. The processes by which these electrodes are manufactured are too complex and involved to be described in a short article of this character, and there are also some presumably secret operations which manufacturers are not willing to divulge at this time. It has been found that the proportions of the ingredients have been varied with the amperage and, to a lesser extent, with the character of the rectified wave supplying the energy.

The packed tube type of electrode is still being used largely, but many failures to start have been directly traced to this type, caused either by dents in the tube or improper packing of the ingredients in the tube.

Of this type of lamp it is probable that there are about 75,000 in service at this time, and prospective business seems to indicate that during 1911 another 50,000 lamps will be installed.

There have been many articles written from time to time, most of them appearing in this publication, outlining the advances made in the form of lamp construction and descriptions of individual installations, and great impetus has been given to improved street illumination by the general publicity that has been given the subject and by the interest displayed in articles of the character above mentioned. The spirit of emulation has been aroused by various published articles outlining the tendency of business men's leagues, civic improvement bodies and other similar bodies to agitate increased illumination for the business streets of their local cities and to demand that the highest class and the latest type of medium be adopted, so that the original movements of this character which commenced in cities of the first class have extended even to cities of the third class, and the fact has been realized that no better medium of advertising the character of a community and its merchandising houses can be had than by having its main streets so illuminated that it will be a matter of comment of the passing traveler and the

newspapers of other communities adjacent to cities where such initiative has been shown.

In this way publications which have devoted themselves to the subject of illumination have been of untold advantage to the central station, to the merchant and to the manufacturer, and by benefiting them have given direct benefit to the public at large.

A second form of lighting is the street series tungsten system, which is rapidly replacing the street series carbon outfits, the matter of efficiency again being the existing factor.

In visiting cities like Los Angeles, St. Louis, Chicago, Dayton (Ohio) and Springfield (Ohio), and observing the high class pole cluster installations which have recently appeared on their streets, you are impressed by the fact that in addition to the requirement that the streets are lighted by high efficiency, high unit source series metallic flame lamps, there is a further demand for artistic treatment of the streets, and this is met by the use of more or less ornate pole cluster lighting with suitable cast iron poles and globes. Some of these appear in three, four and five unit groups, and while it is probable that the amount of energy consumed in these installations is not applied as efficiently as, for example, in the metallic flame arc lamp, yet the artistic sense is perhaps better gratified by the appearance of this form of lighting. In addition to the pole cluster type of installations of this form of lighting there have been a great many installations of a cheaper character, but of the same nature, as represented by the single lamp unit with suitable supporting brackets from poles used in the lighting of second-class streets and alleyways; the popular amperage seems to be 4 to 4½, 5 and 6.6.

Many mixtures and fittings have been placed on the market to meet the demands for such service, so that there is a wide range of choice to the prospective buyer in price and quality as well as in the design.

It is amusing to look back on some of the arguments advanced less than two years ago by some of the central stations to the effect that the high efficiency lamp was bound to cut their earning powers down to a figure very appreciably below what it had been prior to the introduction of such lamps. In looking over the records of a great many central stations it is found that this fear was not justified by the results shown. The actual effect of such lamps of high illuminating value has been to greatly increase the number of units connected. People to-day are using electric light in the home who a few years ago would not have considered they could afford it. The campaign of publicity on the subject in general, as conducted by THE ILLUMINATING ENGINEER and the publications of the larger manufacturers have reached the householder and through them they have had sufficient confidence to begin the use of improved forms of illumination. The older class of consumers, where it was feared the lighting bills would be cut down one-third or one-half what they formerly were, have either put in higher candle-power units or more units of the same candle power, or by the adoption of other electric household devices, such as small fan motors, sad irons, toaster stoves and similar electric heating and cooking utensils, have, if anything, slightly increased their average monthly consumption of electric energy to the benefit of themselves in convenience and safety, and to the benefit of the central station by building up for them considerably more day load than would have occurred had the high efficiency tungsten units not been available for the night load.

The greater bulk of the population coming under electric service lines in the United States, estimated at 40,000,000 people, has not yet been properly approached to develop fully the possibilities which exist among them for the use of better illumination. The writer believes that within the next few years the energies of the manufacturer, dealer and central station will be directed toward this great and undeveloped sale for the absorption of electrical products, the easiest one of which to properly introduce is the modern system of house lighting.

Indoor Street Lighting

By R. E. Campbell.

The comparative operating efficiencies of several high candle-power units was recently brought out in an interesting manner. A test was run on a large 3.5-amp., 115-volt, direct-current inclosed carbon arc with a clear inner and an opal outer globe, a small direct-current carbon arc rated at 5 amp., 118 volts and a cluster consisting of four 3.5-amp., 100-watt series Mazda lamps, under an 18″ porcelain enameled steel shade, all operating under actual service conditions.

The building in which the test was conducted was an arcade about 450 ft. long and 19 ft. 6 in. wide, off from which opened shops of various kinds. Fourteen high candle-power units were hung down the center of the inclosure and spaced about 34 ft. apart, except the two end units, each of which was located in an entrance vestibule. The uniform height of these units was 12 ft. 6 in. above the floor. The walls were almost exclusively the plate glass show windows of the various shops, so that the floor received but little light from the walls and ceiling by reflection.

The comparison was made by laying off twenty stations located as shown in Fig. 1. These stations were spaced 3 ft. crosswise of the building and 4¼ ft. lengthwise and covered an area equal to one-fourth the space which one unit was required to illuminate.

The units were tested under exactly the same conditions—that is, the surroundings remained constant throughout the test, and each unit was hung successively in the same position, thus illuminating the same test area. Adjacent units were turned out during the entire test, in order that the results might show the illumination from a single unit.

The intensities were read on the plane of illumination assumed at 3 ft. above the floor, using a Sharp-Millar portable photometer. This instrument was carefully calibrated both before and after the test, in order that any change in candle-power of the standard lamp could be detected and correction made if necessary. All values of intensity in Table I. are the average of three readings, voltage and current being observed simultaneously with the second reading of intensity in each case.

The results of the test as shown in Table II. need no explanation, since a glance at the value of the average foot-candles per watt gives a means of comparing the illuminants tested.

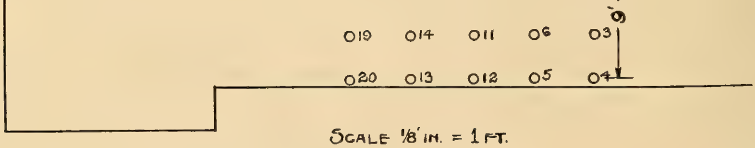


FIG. I.—PLAN OF TEST STATIONS.

FIG. 2.—TAYLOR ARCADE, CLEVELAND.

TABLE No. I.—FOOT-CANDLES.

Station.	Mazda.	Small D. C. carbon arc.	Large D. C. carbon arc.
1	3.12	2.70	1.71
2	2.79	2.32	1.55
3	2.69	1.64	1.21
4	1.80	.84	.92
5	1.51	.78	.71
6	1.89	1.32	.86
7	2.59	2.17	1.18
8	2.70	2.76	1.22
9	1.86	1.89	.87
10	1.72	1.37	.81
11	1.54	1.29	.95
12	1.23	.73	.54
13	.80	.55	.43
14	.92	.77	.42
15	.96	.68	.65
16	.89	.66	.59
17	.61	.51	.46
18	.62	.56	.34
19	.62	.44	.30
20	.56	.36	.25
Average	1.57	1.22	.80

TABLE No. II.

	Mazda.	Small D. C. carbon arc.	Large D. C. carbon arc.
Height of unit	12′ 6″	12′ 6″	12′ 6″
Average voltage	114.7	109.28	115.35
Average current-amp.	3.50	4.692	5.175
Average watts per unit	402	513	597
Average foot-candles	1.57	1.22	.80
Average foot-candles per watt	.00391	.00238	.00134
Variation of intensity above average	98.8%	121.2%	68.8%
Variation of intensity below average	64.3%	70.5%	113.7%
Total variation	163.1%	191.7%	182.5%

A Method of Illuminating a Church Choir

By Robert B. Ely.

"Conservation of the Vision" is a motto that is uppermost in the minds of illuminating engineers, and is a motto that should be the first text in the catechism of the science of illuminating engineering.

Most of us are familiar with that feeling of drowsiness that overcomes us when attending an evening church service, where the light sources are directly in the line of vision, and the subsequent relief to get out on the street and rest the eyes from the harsh effect.

In this particular case the choir was located in the front of the church on a raised platform and illuminated by two gas standards, with five open flame burners on each standard; each burner was equipped with an etched glass shade that did not eliminate the discomfort of having to gaze in that general direction for an hour.

Such a system is doomed to become extinct and every one who has experienced the ill effects of an installation of this kind will thoroughly appreciate the more pleasing appearance and eye rest to be derived by concealing the light source, or decreasing the brilliancy of the light by opal or opalescent globes.

The system described has been in vogue for some time, and we will offer the excuse of old age for its being in existence.

In introducing an appropriate electric lighting installation, this part of the installation resolves itself into a problem that requires the light sources to be concealed from direct line of vision, and at the same time provide sufficient illumination for the choir, the organist and sufficient light on the pulpit to enable the minister to read manuscript if he so desires, and to make the surroundings bright and pleasing to the eye.

The idea of concealing the lamps back of the organ pipes above the organist and of reflecting the light rays forward seemed to be about the best method to adopt, to come within a reasonable expense; so a preliminary test was made, as follows:

Report of Special Test Made on Two Different Specimens of Prismatic Glass to Determine Their Relative Value from a Light Distribution Standpoint.

Specimens Under Test.

Two pieces of prismatic glass, one piece made of frosted glass and having prisms, whose angles are 55 x 75 degrees, and the other composed of clear glass, the prisms' angles of which are 40 x 90 degrees.

Special Apparatus Under Test.

A special pine board box, approximately 18 in. by 12 in. by 6 in., having an opening of the same size as the glass specimens under test cut out of one of its sides, into which the prismatic glass pieces were inserted, one at a time, formed the main body of the apparatus.

Mounted in this box is a 40-watt tungsten lamp and metallic parabola reflector, the prismatic glass being inserted directly in front of the lamp and reflector in such a manner that nearly all of the light from the hemisphere of distribution of light furnished by the lamp and its reflector would pass through the glass under test.

Object of Test.

The object of this test was to determine the relative values of the specimens of

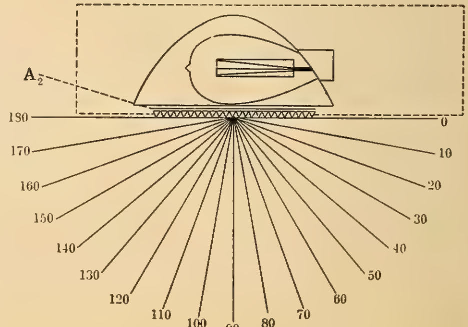


FIG. I.—ARRANGEMENT OF UNIT.

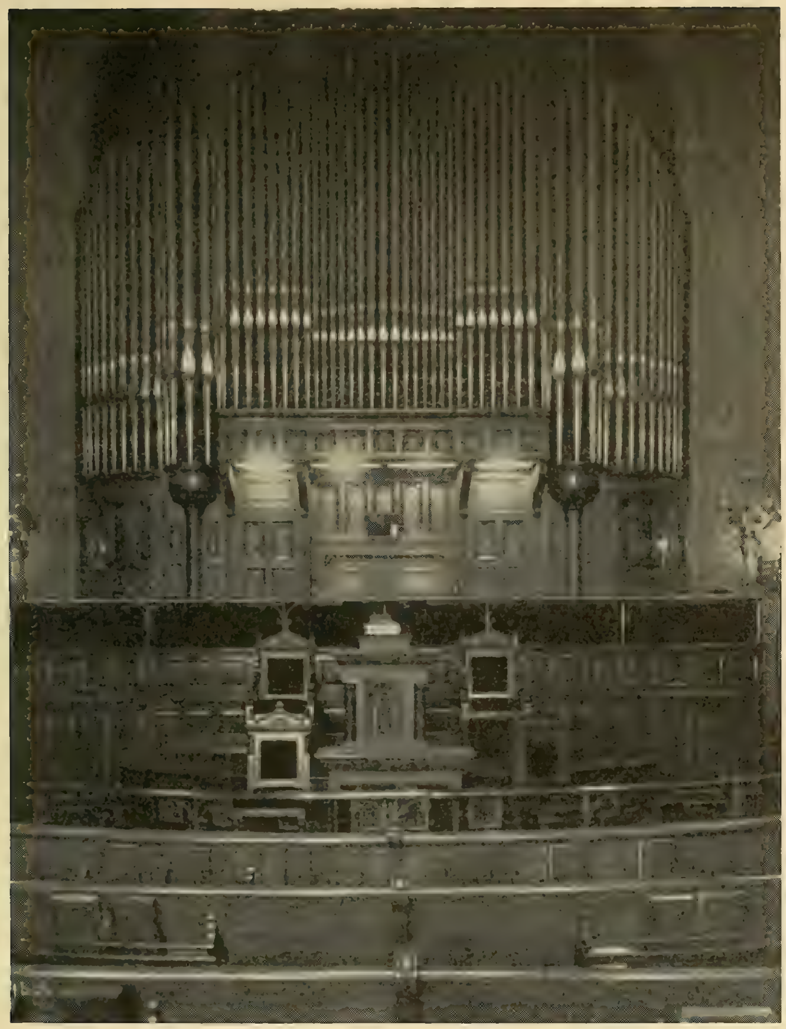


FIG. 2.—CHOIR LOFT, SHOWING EFFECT OF NEW ILLUMINATION.

prismatic glass for light distribution purposes.

Method of Testing.

The special test box was mounted on a movable frame in the test end of a Lummer-Brodhun photometer and the distribution of light through the specimens of glass under test determined; each piece being tested separately and the 40-watt tungsten lamp used, having its rated voltage (118 volts) applied to its terminals at all times during the test.

Results of Test.

The following tables are the results obtained. The readings given are in terms of candle power. Fig. 1 is furnished in order that the different angles of observation could be more clearly understood.

Angle of observation.	Readings in candle-power. Using clear glass in "A" 2.	Using frosted glass in A2.
0 Hor	0	0
10	3.4	3.7
20	6.9	7.8
30	12.0	16.0
40	16.0	20.0
50	26.0	23.0
60	26.0	24.0
70	35.0	25.0
80	40.8	31.0

Angle of observation.	Readings in candle-power. Using clear glass in "A" 2.	Using frosted glass in A2.
90	40.6	36.0
100	40.4	34.0
110	39.0	31.0
120	37.0	26.0
130	28.0	19.0
140	20.5	19.0
150	18.2	20.0
160	19.2	15.0
170	11.0	7.5
180 Hor	0	0

The results of this test seemed to warrant the introduction of the system, and the "A 2" tile was recommended, but by further experiment I found that the lamps placed somewhat farther from the glass tile gave better results, and the installation was made by removing four wooden panels from under the overhanging section of the organ, and building wooden boxes over each panel 10 in. high and 21 in. long. They were then lined with white asbestos and holes bored in the top for ventilation; in the top of each box a ceiling receptable was installed and a 60-watt tungsten lamp placed, equipped with a white porcelain reflector; this permitted the sides and the top of the box to reflect the light, so that it was well diffused within the box and reflected through the panels of prismatic glass.

The four lamps are controlled by a push switch aside of the organist, and the results are very pleasing. The choir is better illuminated than heretofore, and this method of installation is at a minimum of expense, and is possibly one way of correcting a grievous fault.

Special Illumination from a Tubular Source of Light

By William S. Kilmer.

III. Show Case Lighting.

To meet an ideal condition a show case should contain at least twice the illumination of the surrounding area. Prior to the advent of the tungsten linolite lamp this had been practically impossible for several reasons, the principal ones being, that the clear contour of the case must be unimpaired, temperature must be low and constant for perishable goods display, all parts of the case must be accessible for cleaning, and low current consumption.

When we stop to consider that the average department store contains approximately ten times as many lineal feet in show cases as show windows, the problem requires careful study.

The accompanying illustrations show how the problem was solved by Stern Brothers in their new department store on Twenty-second street, New York City; over two thousand feet of the illuminant was used for show cases and display cabinets only. The consumption remaining practically constant at 100 watts per 10 feet, the general illumination of the store is about 3 to 3.5 ft. candles, consequently the show-case lighting was brought to approximately 7-ft. candles.

Fig. 1 shows the distribution of light in a plane containing the lamp axis of the linolite single unit used, the lamp being the 25-watt, 27.5-volt type. These lamps are connected four in series on 110 volts, each set of four lamps having a range in amperes not greater than .05, which gives an absolutely even distribution of light and equal life to the lamps. The advantages of a low voltage high efficiency lamp are numerous, the principal one being that the filament is three times the diameter or nine times the cross-section of the regular 25-watt, 110-volt lamp, thus the mechanical strength is far greater and disintegration of the filament takes place much slower.

Fig. 2 shows the effect on a show display case, 12 ft. by 18 in., where goods may be seen on all sides from the aisles; this style of case is without doubt the most difficult form known to properly illuminate.

Fig. 3 shows a leather goods display containing black, brown and red leathers.

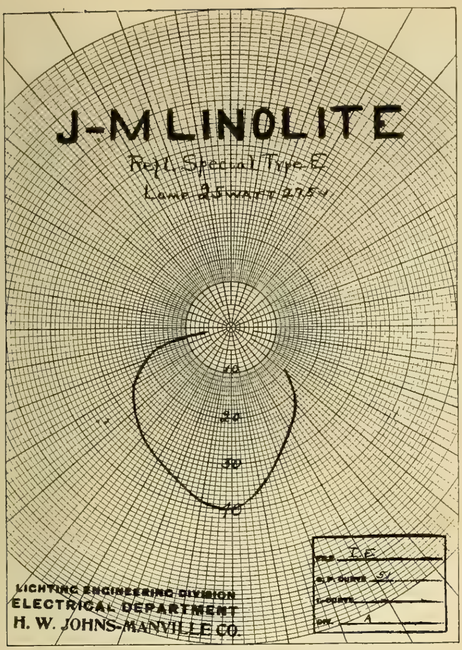


FIG. 1.—PHOTOMETRIC DISTRIBUTION CURVE OF TYPE OF UNIT USED IN THIS INSTALLATION.

The clear white rays falling on these goods brings out the detail clear and sharp, rendering sales work easier, as a closer selection of goods can be made without removing half the goods from the case, as the fastidious customer occasionally demands.

Shop-worn goods from this cause alone means a loss of a considerable sum to the merchant.

Fig. 4 shows the display of an entirely different class of goods. The general effect on the eye is brighter as the goods are mostly white and brown. This case is adjacent to an angle case with round ends containing the same display, the entire case, including angles and curves, being equally lighted from the same angle, which shows the remarkable flexibility of the unit.

Of course, many variations from the regular cases are encountered in this class of work, one being the display of imported gowns and lingerie. The cabinets used for this are uprights, about 6 ft. 6 in. high, closed at three sides, with clear glass door, sides and back paneled with mirrors.

Four lamps are ample for the illumination and are entirely concealed at intersection of the top with sides.

Fig. 5 shows the four lamp unit used for the entire installation.

IV. Automobile Window Display.

To properly display and attract the passer-by, one must either brilliantly illu-

FIG. 2.—SHOW CASE ILLUMINATION WITH LINOLITE TUNGSTEN LAMP.

FIG. 3.—A LEATHER GOODS CASE ILLUMINATED WITH LINOLITE TUNGSTEN LAMPS.

FIG. 4.—A WHITE GOODS CASE BY LINOLITE ILLUMINATION.

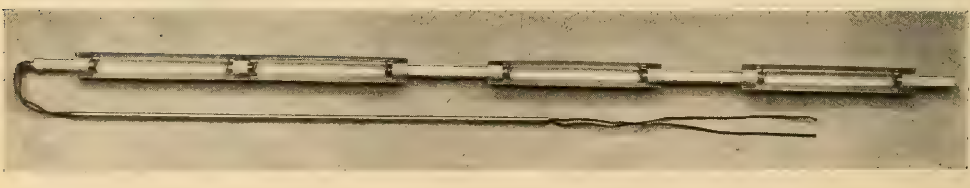


FIG. 5.—TYPICAL SECTION OF LINOLITE SHOW CASE UNIT.

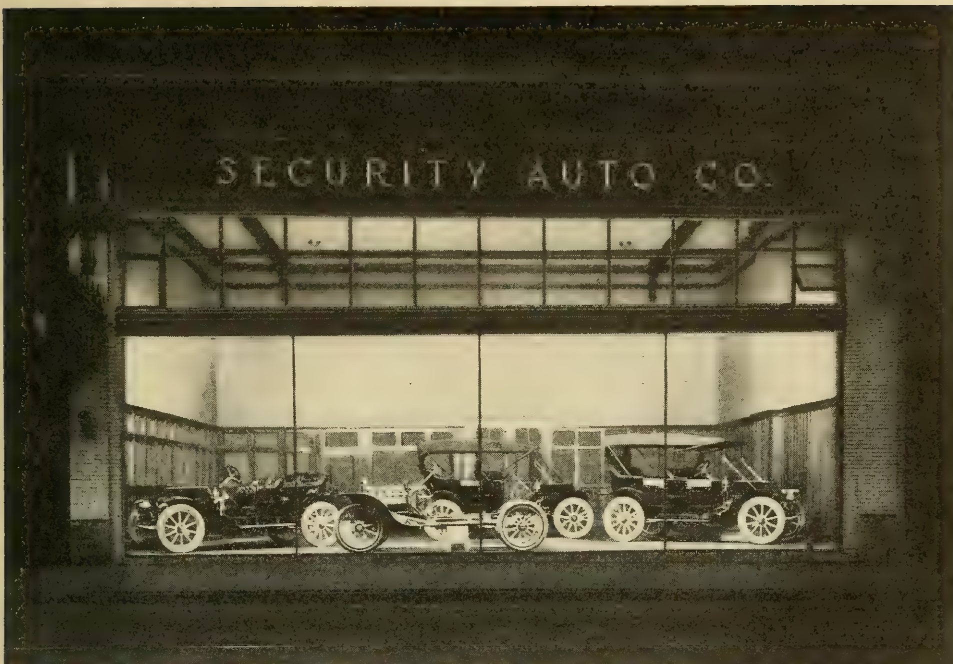


FIG. 6.—A SHOW WINDOW USING LINOLITE UNITS.

minate the entire floor space which runs unbroken to the front of the window or inclose a large area for the window display; this latter method is probably preferable to bring out detail.

Fig. 6 is a window with 40-ft. frontage and 25 ft. deep, the sole source of illumination being a 40-ft. continuous section of linolite lamps, using the 30-volt, 35-watt unit, which is placed entirely out of the range of vision; the reflector being designed for this class of work renders uniform illumination regardless of the excessive depth of the window.

A Misstatement of Fact

By H. B. Wheeler.

The Illuminating Engineer is read with interest and profit by thousands engaged in the betterment of lighting conditions. That statements that are positively incorrect, or indirectly misleading, will occasionally appear in contributed articles may be expected. Were knowledge complete and all differences of opinion reconciled there would be no occasion for the publication of the magazine; but as illuminating engineering is far from realizing these conditions your policy of providing an open court in which any one may "have his day" in which to express his opinions "to the best of his knowledge and belief" is both commendable and helpful. Inadvertent misstatements may readily be condoned, for they at most convict the writer only of carelessness or haste; but when misstatements are made which indicate an ulterior motive the case is quite different, and reflects discredit upon the profession, and the magazine and society which represent it.

This statement is called forth by an article in your February issue, entitled

" Idealism in Illumination Design," contributed jointly by two members of the Illuminating Engineering Society. Under the sub-heading in this article, " Limitations of Indirect Lighting," the statement is made that " Experience has shown conclusively that with indirect illumination the imperfect diffusion beneath the suspended and inverted reflectors produces variations which obliterate detail to such an extent that, in a large ballroom in the West equipped with this system, it is absolutely impossible to recognize the features of a person standing at a distance of 50 feet."

Your Western readers will at once recognize the auditorium, or ballroom, of the South Shore Country Club, Chicago, as the installation thus referred to. We can only assume that the writers responsible for the statement have never seen the room illuminated by this installation, and must therefore have committed themselves to this gross misstatement of fact on mere hearsay evidence. This is unfortunate, since one such evident error in an article throws a strong suspicion of inaccuracy and prejudice produced by ulterior motives upon not only this particular article but upon all other contributions by the same writers.

The fact in the case, which is at once recognized by every one familiar with the illumination of the room mentioned, is that the ability to not only recognize, but to distinguish clearly the features of a person for more than twice this distance, is one of the most distinguishing and pleasing features of the illumination. Seen from the adjoining room the effect is like looking out into the open on a bright day when the sun is just hidden by white clouds; the shadows being removed, and the harsh high lights subdued.

This auditorium is perhaps the chief feature of attraction of the buildings of this well-known club, and the illumination provided has been frequently and freely commented upon by every club member and visitor as the most pleasing feature of the beautiful interior. Those who are familiar with the salons and ballrooms in the capitols of the world have stated that it is the most beautifully illuminated interior of its kind they have ever witnessed, and the ability to clearly see and recognize people at a distance of 100 feet or more is a source of delight and surprise. This installation, in which not a direct lighting unit is to be seen, was the subject of an article in one of the previous issues of THE ILLUMINATING ENGINEER.

The profession of illuminating engineering is too dignified, and the conservation of vision movement too large and important, for workers in the field to descend to personalities. In the interest of the science and art of illumination, as well as professional courtesy, is it not fair that a correction of such erroneous and misleading statements should be made?

Recent Achievements in Artistic Lighting Glassware

By S. G. HIBBEN.

Starting the new year's development of the line of artistic glassware for the lighting of extensive spaces come two remarkable and truly beautiful achievements in glass making. The first of these is the largest single piece of illuminating glass ever pressed up to this time, and is shown as part of the fixture represented in Fig. 1. This triumph of the art is in the form of a hemisphere or bowl intended for use where it can be suspended by rods or chains in the shape of an artistic and complete fixture, and lighted from within by three tungsten lamps. The bowl is of Alba glass in the representation of carved alabaster or Carrara marble. It measures 22 in. in diameter, and has upon its snow-white surface a relief design of classic origin, enhancing its beauty when not lighted and lending a delicate touch of shadow decoration from the transmitted light when in service.

Fig. 2 shows another mammoth piece of pressed glassware, forming in two sec-

FIG. I.—A SEMI-INDIRECT UNIT WITH ALBA BOWL.

tions an urn—also of Alba glass. This measures 15 in. across, and on account of its design, is particularly adapted for use in dining-rooms, banquet halls, lobbies and rooms decorated in white tile or marble. It has ample space within for the accommodation of several lamps. Both of these fixtures as shown are wired down the pendant rods, and have lamp sockets attached to the bolts, which clamp the metal supporting arms to the glass.

The actual value of these innovations will appear evident to the fixture manufacturers and architects, as they are the opening for future possibilities in the much-to-be-desired development of glassware which can be made to harmonize with its accessories and the other interior decorations. They will also enable the consumer of electric power to see the portion from which the light proceeds, as the prominent part of his lighting fixture, rather than the light-sources, as being secondary to a display of elaborate metal.

Whatever the near future will bring forth, it appears fairly evident that the limit of large decorative pieces is far from being reached. Achievements that a year ago were held to be impossible are now not only possible but actual and practical as well. The makers of these large pieces are already working toward larger achievements to supply a growing demand for unique and highly decorative wares.

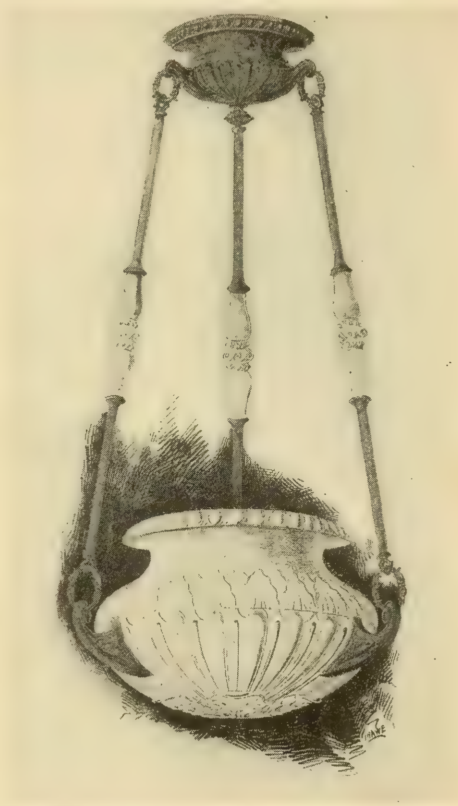


FIG. 2.—ANOTHER SEMI-INDIRECT UNIT USING AN URNLIKE BOWL OF ALBA GLASS.

The Place of the Arc Lamp in Illumination

By R. F. Pierce.

Before the development of the metallic filament incandescent lamp, the arc lamp practically monopolized a very definite field, in which its peculiar fitness was never seriously disputed. Recent improvements in the incandescent lamp have, however, to a great extent, overshadowed corresponding progress in the arc lamp, and the former has obtained a degree of attention which is by no means deserved.

To be sure the incandescent lamp is susceptible of wider and more diverse applications than the arc lamp, but in some fields, particularly in street lighting, the latter has been so universally accepted that this field has always been considered as the peculiar province of the electric arc lamp. From a survey of the recent projects in street lighting, which have gone forward during the last year, one would gain the opinion that those responsible for these projects have serious doubts as to whether the arc lamp has any reasonable excuse for existence.

The use of incandescent units for really pretentious street lighting is such a radical departure from the established practice, that it is interesting to inquire into the causes of this far reaching innovation. For this purpose, a sketch of the modern development of electrical street lighting will be useful, particularly those developments which have been peculiar to America. We designedly say developments rather than improvements as the latter have most certainly not predominated. Electrical street lighting may be said to have begun with the open arc lamp and until the exploitation of the inclosed arc lamp, in 1894, the open arc lamp practically monopolized the electrical street lighting field. At this time a wide diversion between American and European practice developed. The old open arc lamp as generally used, possessed one decided defect and two limitations which were very obnoxious to the electrical interests in America. The defect referred to was the character of the distribution curves by which the entire output was practically concentrated in the direction of about 45 degrees from the horizontal. This defect would have been easily rectified and the distribution curves shaped to any desired form by the use of opalescent glass ware of proper design, and in fact this result was secured to a most satisfactory degree abroad.

Limitations of the Carbon Arc.

The principal limitations of the open arc lamp were the necessity of using carbons of a particularly high grade, in order to secure a quiet and steady arc, and as the only available source of raw material for carbon manufacture existing in America is the impure refuse from the distillation of petroleum, and the manufacture of illuminating gas, it was necessary in order to secure really good results to use imported carbons. Furthermore the open arc required sensitive feeding mechanism and for this purpose the only satisfactory mechanism was found to be the so-called clock feed, which is used for practically all types of arc lamps in Germany. The cheap, crude and simple clutch mechanism, which for obvious reasons appealed to the American manufacturer was entirely unsuited for the operation of the open arc.

Regarding the foregoing points, we might quote from Dr. Louis Bell, who after returning from a European trip, undertaken for the inspection of the most prominent street lighting installations in Europe, said, " The inclosed arc lamp that has been considered the standard in this country has never been adopted for general illumination."* Dr. Bell explained that the inability to obtain suitable electrodes at a reasonable price was the chief cause for the adoption of the inclosed arc lamp. In another article he states, " The foreign open arcs, thanks to high grade carbons and sensitive feeding mechanism, are substantially as steady as American inclosed arcs."† Dr. Bell especially commented upon the superior results obtained

*El. World, Feb. 25, '09, p. 487.
†El. Review, Mar. 13, '09, p. 469.

in Germany by the use of open arc lamps, and his comparison of German with American street lighting was by no means flattering to the latter. So impressed was he with the backwardness of America in street illumination that he stated in these articles that he had forsaken the ranks of the " shrinking apologists " for the utterly inadequate street lighting which now prevails in this country and would stand uncompromisingly for a higher standard such as that prevailing abroad.

In Germany it is customary to provide on principal business streets, at least five and sometimes ten times as much light as is customary in America. It should not be assumed, however, that this increase in efficiency requires a corresponding increase in cost. The units used abroad produce from five to ten times as much light for a given current consumption as those in common use in America, and the cost of street lighting in Germany is entirely reasonable even from the standpoint of the average appropriations now made for street lighting by American municipalities. It would appear, therefore, that the invention of the inclosed arc lamp, far from being a step in advance, was a very decided step, not to say leap, backwards. It is undoubtedly responsible for the backward position of America in street lighting, and it is safe to say that if the American manufacturers had for the past fifteen years devoted their time to the improvement of an arc lamp, along the same lines that have been followed in Europe, the average American municipality would be four or five times as well lighted as it is at present.

The Inclosed Arc.

The advantages claimed by the exploiters of the inclosed arc lamp were: Distribution of light more suitable for street lighting, steadier arc, long burning life of electrodes. As has been shown, the first two advantages could have been obtained equally well by the use of open arcs and the longer burning life is more than offset by the enormous decrease in efficiency. The open arc lamp, properly designed and operated, can be made to yield about two candle-power per watt, while the best that can be obtained from the inclosed arc lamp is about 1/4 of a candle-power per watt. As electrical energy is by far the most important item of expense entering into electric lighting, it is hard to conceive how the advantages obtained in the way of burning life by the inclosed arc lamp can be conceived as off-setting a waste of current of about 800 per cent. The explanations of the exploiters of the inclosed arc lamp must be regarded as more ingenious than ingenuous.

In comparing the inclosed arc lamp with the other units that have been available in America for street lighting purposes during the past fifteen years, elimination of the open arc lamp leaves only the carbon filament incandescent lamp and the Gem incandescent lamp. Both lamps have practically the same efficiency as the inclosed arc lamp. To those who have been accustomed to regard the inclosed arc as a 750-c.p., 3/4 of a watt per candle unit and the carbon filament incandescent as a 3 1-10-watt per candle-power unit, this statement will appear ridiculous, but a little investigation will show that the real average efficiency of the inclosed arc lamp is not over 2 1/4 watt per candle, and the mean lower hemispherical candle-power of the 550-watt direct current inclosed arc lamp is not over 250. A test of a number of 5 ampere direct current inclosed arcs showed an average mean lower hemispherical candle-power of 239 (section 12, page 175 standard handbook for Electrical Engineers, edited by Dr. Louis Bell).

The Incandescent Lamp.

The 3 1-10-watt per candle carbon filament incandescent lamp with prismatic reflectors will give 18 mean lower hemispherical candle-power or an efficiency of 2 3/4 watt per candle. The Gem lamp has, under the same conditions, an efficiency of about 2 watts per candle. Considering the higher maintenance charges and increased investment incurred by the inclosed arc lamp, it is evident that any street lighted by inclosed arc lamps could have been supplied with equal candle-power at less cost by substituting incandescent lamp groups of equal candle-power, and at an enormous gain in uniformity of illumination, provided such uniformity had been regarded as a real bene-

fit. As such a change would have been directly in line with the interests of the lighting companies, it is unnecessary to say that it would have been quickly effected had it not been for the existence of some overpowering objection to the use of incandescent lamps for this purpose. The nature of this objection is at once disclosed in the criticisms which are now being made against many so-called "Great White Way" installations of tungsten lamps. In many of these cases inclosed arc illumination has been replaced by two or three times the quantity of illumination by tungsten lamps, and yet the citizens, and particularly the business men, complain of the insufficiency or rather inadequacy of illumination.

This forcibly calls to mind what has been known for a long time by illuminating engineers, but evidently entirely forgotten in the design of tungsten lamp street lighting installations, and that is the inherent inferiority of the incandescent lamp on account of its lack of brilliancy. This principle has been recognized in Germany, which admittedly leads the world in street illumination, and it is significant to note that in Germany, where the tungsten lamp originated, the latter is never used for the illumination of streets requiring any considerable degree of intensity. It is recognized that street illumination by small units produces too small a variation between a maximum and minimum to impress the observer with the brilliancy of the illumination. In other words, uniformity of illumination, far from being desirable, is a serious drawback. Within reasonable limits, it may be said that no amount of light radiated from a long filament such as is used in incandescent lamps can give the required impression of brilliancy in the light-source, and the splitting up of one large unit into several small ones obviously decreases the effectiveness of the illumination.

The Double Purpose of Street Lighting.

Good street lighting must serve two purposes. It must produce sufficient illumination for the practical purposes involved, such as distinguishing irregularities in sidewalks, etc., at a reasonable distance and permit the easy recognition of faces. The efficacy of street lighting as a crime deterrent depends largely on the latter. On the other hand, and this is far more important, it must produce an impression of brilliancy, liveliness and opulence, as its commercial value depends almost entirely upon its psychological effect upon those in the street.

A survey of several European street lighting systems, which have been especially commented upon by American electrical engineers as representing the highest development of street lighting, indicates the following as the principal essentials in street lighting:

First, a satisfactory minimum illumination, certainly not less than that represented by 1-10 foot-candles on a horizontal plane.

Second, a ratio of maximum to minimum of not less than 3 or 4 to 1.

Third, the use of the largest practicable units in order to avoid, so far as possible, posts and poles, neither of which are legitimate features of any street and should be eliminated so far as possible. Obstructions to traffic, which serve no useful purpose, being entirely lacking in utility, which is the prime requisite of art, cannot be conceived by any stretch of the imagination as being either beautiful or decorative.

Advantages of the Flaming Arc.

Considering the various units available for street illumination of the better class, the flaming arc lamp possesses such enormous superiority over all other units that the comparatively slow progress which it has made in this country has been a matter of surprise to most illuminating engineers. The causes, however, have been almost entirely commercio-political, and the education of the public regarding different types of lighting units and their efficiency will undoubtedly result in gaining for American municipalities at least a portion of the advantages which have heretofore been withheld from them. If one's opinion were based entirely upon the form of contracts now in force for city street lighting, one would inevitably come to the conclusion that the only thing considered had been the expenditure of the greatest pos-

sible amount of money for the least possible returns. It is worth while pointing out at this juncture that the flaming arc lamp possesses over thirty times the advantage over the tungsten lamp (as far as efficiency is concerned) that the inclosed arc lamp possessed over the carbon filament incandescent lamp. In other words, the inclosed arc lamp produced but 22 per cent. more light than the carbon filament incandescent lamp for a given current, whereas the flame arc lamp produces five and one-half times as much light as tungsten units consuming the same current. It is evident, therefore, that the present vogue of the tungsten lamp for street lighting is decidedly not in the line of progress, and must, therefore, be attributed to reasons entirely aside from the efficiency, economy or desirability of this lamp for this purpose.

The trend of industrial lighting development has clearly shown that efficiency, like youth, will be served. The flaming arc lamp was, not more than five years ago, decried as an impossibility so far as industrial application was concerned. To-day the flaming arc lamp practically monopolizes the field wherever the use of high candle-power units is permissible. Ultimately the same considerations must prevail in street lighting as soon as municipalities are convinced that street lighting is a business proposition and not merely a means of dissipating revenues. The movement for efficiency has gained in force through its repression and the inevitable result must ultimately be the occupation by the flaming arc of the field to which it is so well entitled. If America is ever to lead the world in street illumination, or even to obtain a place worth mentioning, it will most assuredly not be by the use of the present inefficient units.

The flaming arc lamp appears to be the only prospect of obtaining any considerable improvement in American street lighting standards without prohibitive cost, and the demands of progress must inevitably compel its use in some form.

The Lighting of a Large Power House

By W. A. D. Evans.

The power house under consideration is the Seventy-fourth street generating plant of the Interborough Rapid Transit Company of New York, which operates the subways and elevated lines of the city. The boiler rooms, the main engine room and the basement are illuminated with Cooper Hewitt lamps. This installation has been in service since 1907 and accurate data kept of the life of each tube, thus furnishing an unusually long and accurate record of maintenance cost. Such data must necessarily be of practical value, not only to illuminating engineers but to all who are responsible for the installation and maintenance of commercial lighting systems. We will take up each room in detail and then summarize.

Boiler Rooms in the Seventy-Fourth Street Power House.

The boiler rooms are each 374 ft. long by 94 ft. wide, the space between the boilers being 18 ft. The height of the ceiling is approximately 30 ft. The lower boiler room has a small machine and work shop located at the east end. The two rooms are lighted by 40 type "H" automatic Cooper Hewitt lamps, run eight in series on a 500-volt direct current circuit at 3½ amperes per series. These lamps were placed in service between April 12 and August 26, 1907. There are nineteen lamps placed in the upper room and twenty-one in the lower room, the two extra in the lower room being used to

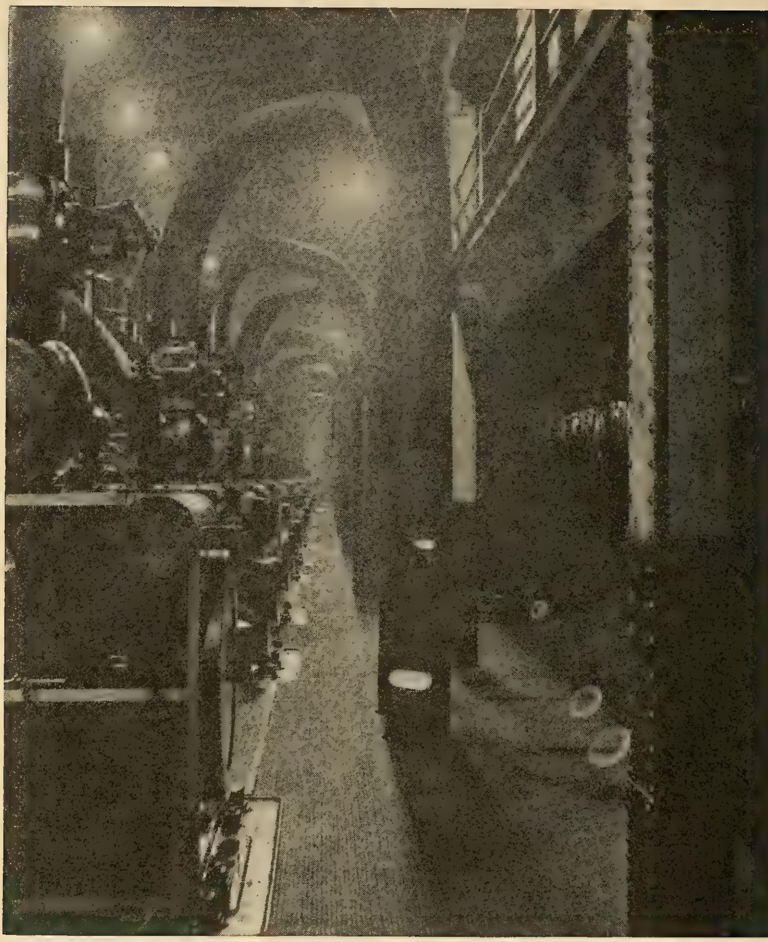


FIG. 1.—SEVENTY-FOURTH STREET POWER HOUSE, INTERBOROUGH RAPID TRANSIT COMPANY, NEW YORK, SHOWING EFFECT OF COOPER HEWITT ILLUMINATION.

light the machine and work shop. The lamps are placed on a center line between the boilers at intervals of approximately 20 ft., as shown on the plan, and are hung at a height of about 18 ft. from the floor.

The forty lamps installed displaced forty-four 5-ampere arc lamps, which were run four in series on a 500-volt circuit. The light from the Cooper Hewitt lamp has proven much better than that from the arcs, due to the even distribution which is obtained over the entire floor and between the boilers; while the low intrinsic brilliancy has materially lessened accidents which formerly occurred, due to the firemen being dazzled by the arc and catching their hands in the automatic stokers. The forty-four arcs consumed a total of 27.5 kw. against 8.75 kw. for the Cooper Hewitt. The Cooper Hewitt lamps illuminate a space between the boilers of 16,200 sq. ft., which gives an average of 400 sq. ft. per lamp and approximately .5 watts per sq. ft. with a candle-power illumination of .75 c. p. per square foot.

Up to January 1, 1911, the forty Cooper Hewitt lamps in the boiler rooms had had ninety-six renewals. The average life on the ninety-six burnt-out tubes had been 7,944 hours, and the average life on the forty tubes still burning is

11,361 hours. During the entire time these lamps have been in service twenty-four hours per day.

Basement.

In the engine room basement on the north side of the building there are fifteen type "H" lamps. These lamps are run five in series on 250 volts, and are a trifle smaller than those used in the boiler room, and give approximately 250 c.p. each. The lamps are so placed that no definite figures can be given on the light per square foot, as they are located so as to light certain portions of the machinery in the basement. The total wattage consumption is 2.63 kw. These lamps replaced an installation of 12 arc lamps, which were run four in series on 500 volts, having a total wattage of 7.5 kw., which shows a saving of 4.86 kw.

The lamps in the basement were installed between November 25 and December 31, 1907. These 15 lamps have had 39 renewals; the average life of the 39 burnt-out tubes has been 5,015 hours, and 13,914 hours is the average on the 15 tubes now burning.

Engine Room.

The engine room contains eight 5,000 kw. cross compound engines direct connected to the generators, with a turbine at the east end. To properly light this

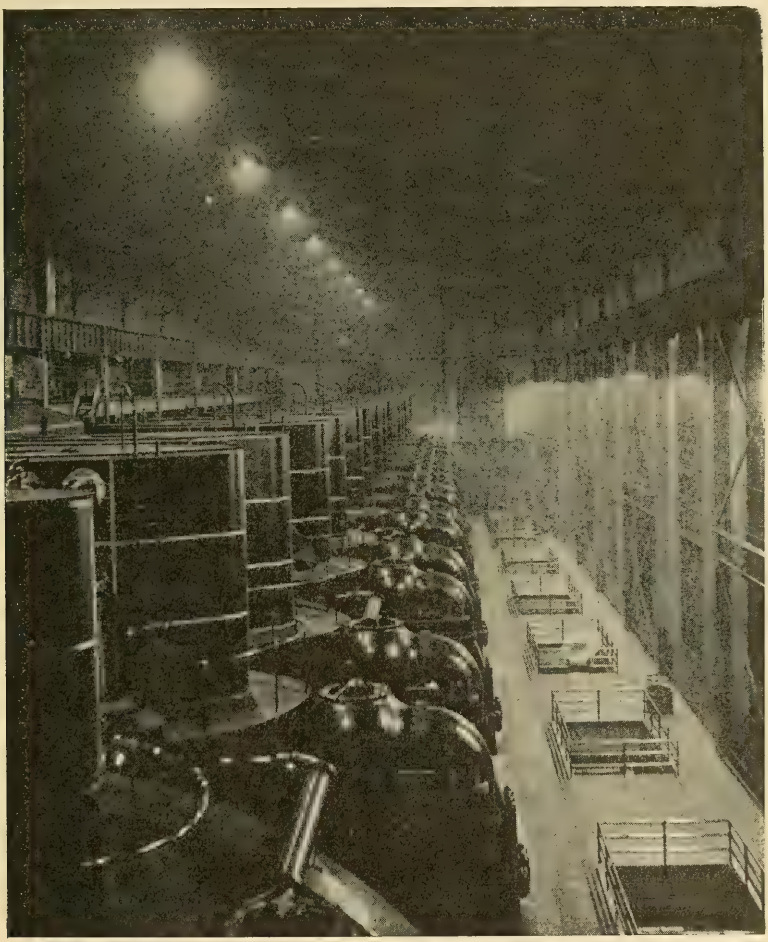


FIG. 2.—ANOTHER VIEW FROM GALLERY LOOKING EAST, TAKEN BY COOPER HEWITT ILLUMINATION.

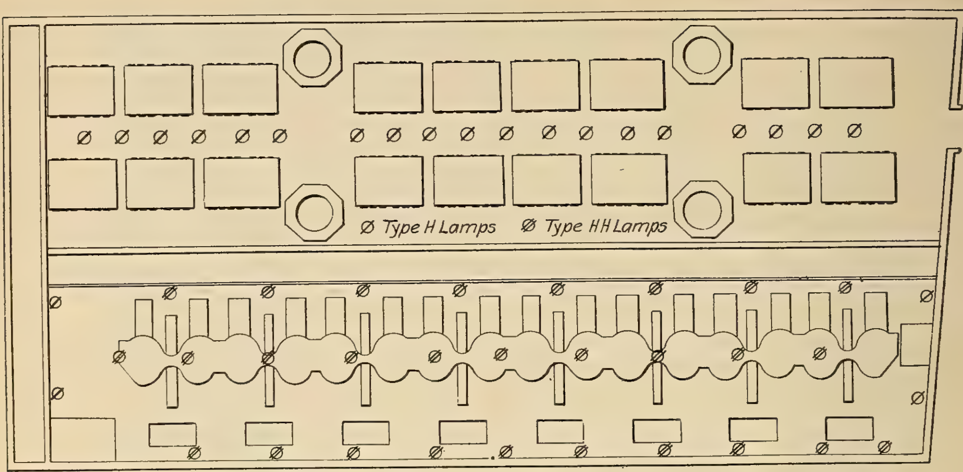


FIG. 3.—FLOOR PLAN, SHOWING ARRANGEMENT OF UNITS.

room it was necessary to throw the light on the valves at the intake side, which is on the north side of the building and also on the upper portion of the engine to cover the upper valve mechanism.

These engines were formerly lighted by rows of incandescents strung along the roof trusses and the side walls; also a number of lights on the machines. On the roof trusses and side walls 1,412 16-c.-p. incandescent lamps were replaced by the Cooper Hewitt lamps. It was necessary to leave a certain number of incandescants on the engines under the bridges and under the steam chest, where it was impossible for any overhead light to be thrown. The lamps were placed as shown on the plan. Ten double type "H" Cooper Hewitt lamps, which consist of two 21-in. tubes placed side by side under a common reflector, are hung in a straight line down the center of the room at a height of 60 ft. from the floor and 35 ft. from the top of the engines. The illumination is sufficient to light all of the upper parts of the engines, and also to aid materially in the floor illumination.

On the north side of the building eight double "H" lamps are placed, hung from the switchboard gallery, placed directly over the intake pipes of the engines. They illuminate sufficiently all the operating mechanism of the machinery on the floor. These lamps are placed at a height of approximately 20 ft. from the floor.

On the south side of the building there are placed ten type double "H" lamps, hung out on iron brackets from the columns. These lamps are 25 ft. from the floor and illuminate all this side of the building, and also throw light down into the condenser pits.

At the west end of the building there are two single "H" lamps, hung from the gallery and placed so as to light the turbine. At the east end of the building there are also two single "H" lamps.

The double "H" lamps are run two in series on 250 volts, while at each end of the room two single "H" lamps are run in series, with one double "H" lamp. The total power consumption is 13.13 kw. against a former consumption of approximately 84.72 kw.

On the basis of double "H" lamp—that is, assuming that the two single "H" lamps at each end of the room to be equivalent to one double "H" lamp, we have for the floor area, which is 37,800 sq. ft., 1,260 sq. ft. per lamp—which gives us an energy consumption of practically .35 watt per sq. ft. and .5 c.-p. per sq. ft.

The lamps in the engine room were installed in the latter part of December and the first part of January, 1910, so that the figures on maintenance are not as conclusive as in the boiler room and basement. These lamps also run approximately 4,000 hours per year, as very little light is required in the engine room

throughout the day. The light over the entire floor, however, is even throughout, and from the chief operator's office it is possible to see any part of the floor and observe whether or not the men are doing their work properly. This was impossible with the previous system of lighting, as the room was dark throughout.

SUMMARY.

	Lamps.	Volts.	Per lamp. Watts.	Per lamp. C. P.	Total K. W.	Total C. P.	Sq. ft.	Sq. ft. per lamp.
Boiler room	40 H.	500	219	300	8.75	12,000	16,200	405
Basement	15 H.	250	175	300	2.625	3,750	.....	....
Engine room	4 H.	...	219	300	.....	.....	.....	....
	28 HH.	...	...	...	24.5	33,750	37,800	1260
Total	59 H.	...	...	...	.....	.....	.....	....
	28 HH.	250	438	600	13.125	18,000	.....	....

	Watts. Sq. ft.	C. P. Sq. ft.	Former install.	Watts.	Total K. W.	K. W. saved.	Average life. Burnt out tubes.	Average life. Present tubes.
Boiler room	0.54	0.74	44 Arcs.	625	27.5	18.75	7,944	11,361
Basement	...	...	12 Arcs.	625	7.5	4.875	5,015	13,914
Engine room	0.35	0.48	1,412 Inc.	55	77.6	64.475	1,003	3.568
Total	...	...	....	...	112.6	88.1	....	.....

Of the saving, 23.625 K. W. are for 8,700 hours per year .... =205,537 K. W.-hours.
And .... 64.475 K. W. are for 4,400 hours per year .... =283,690 K. W.-hours.

Saved per year .... =489,227 K. W.-hours.

MAINTENANCE ON TUBES PER YEAR IN BOILER ROOM AND SOUTH BASEMENT, ON 55 LAMPS.

1907	7
1908	55
1909	45
1910	28
Total	158

Average per lamp = 2.88 tubes in 3½ years.
Or 0.82 tubes per lamp per year at $8 = $6.56 per lamp per year.
Or $0.76 per 1,000 hours.

ENGINE ROOM AND NORTH BASEMENT.

28 Double "H." and 12 Single "H." Lamps, or the Equivalent of 68 "H" Lamps.

1910	31
Total	31

Average per lamp = 0.456 tubes in one year.
At $8 = $3.64 per lamp per year.
Or $0.83 per 1,000 hours.

Five of the tubes installed in 1907 are still burning. The individual life of these tubes is as follows:

One tube at .... 32,481 hours.
One tube at .... 29,361 hours.
Three tubes at .... 27,174 hours each.

BOILER ROOM.

K. W.-hours per lamp per 1,000 hours .... = 219
Cost of tube .... = $0.76
Cost per K. W.-hour for maintenance .... = 0.0035

ENGINE ROOM.

K. W.-hours per lamp per 1,000 hours .... = 219
Cost of tube .... = $0.83
Cost per K. W.-hour for maintenance .... = 0.0038

This is for a 300 candle-power lamp.

Indirect Illumination in Winnipeg, Canada

By T. Leslie DeCew.

There is possibly no portion of the country where the quality of artificial illumination is more highly appreciated than in Winnipeg, Canada. This is probably due to the long winter evenings, which have made it necessary to adopt the best methods of lighting obtainable. The tungsten lamp was gladly welcomed as giving "more light," until those who had occasion to use it for any protracted period found that the eye strain was increased out of proportion to the benefits derived.

About the first of the present year R. G. Dun & Co. were getting their new offices in shape for occupancy, and had given considerable thought to the question of lighting. The attention of their local manager, Mr. F. B. Matthews, was directed to the use of inverted units, which appealed to him as a most rational and unique way of handling the high candlepower tungsten lamps.

The space to be lighted was 36 x 84 ft., with ceilings 11 ft. high. The room is divided lengthwise by a series of columns set 14 ft. between centers, presenting twelve bays each 14 x 18 ft., or approximately 250 sq. ft. each. An outlet was placed in the center of each bay and equipped with a 4-unit inverted fixture hung 36″ from the ceiling, each containing four 60-watt clear bulb tungsten lamps and a concentrating type of reflector. The results are very gratifying. There is not a desk lamp in the whole office, and the staff are loud in their praise of modern illumination.

Mr. Matthews writes: "We are pleased to state that the system has proven very satisfactory, and we have heartily recommended it to others. We find the expense about the same as our old system, but the relief to the eyes makes it worth a great deal more." There seems to be a peculiar feature about this method of lighting which affects all users the same.

Not unlike religion, when they "see the light" they are so filled with enthusiasm they feel constrained to tell their friends. An installation in the offices of the Manitoba Government Telephones was quickly followed by those in grocery, hardware, clothing and cigar stores; various offices, banks and residences until at present there are approximately one hundred installations of indirect lighting in Winnipeg.

This is truly remarkable when one stops to consider that it is not yet ten months since the first installation was made here. The local Y. M. C. A. adopted it for three rooms in their temporary building, viz.: the lecture room, auditorium and physical director's office. T. Duncan Patton, the General Secretary, writes: "I am pleased to say that up to this date it is very satisfactory. Everybody is pleased with the appearance of the rooms lighted, and I am hearty in my recommendation of the reflected system." An installation in the Commercial Club elicited the following: "I have pleasure in testifying to the great success which indirect lighting has accomplished for the above club, and have no hesitation in saying that I do not think there is a better light to be obtained for reading or writing purposes."

A typical office is that of the Prudential Life Insurance Company. Their offices are a trifle larger than those occupied by R. G. Dun & Co. in the same building, having a board room additional, approximately 14 ft. x 18 ft., ceilings are same 11 ft. This gives them a total area of over 3250 sq. ft., their current consumption is 2300 watts or .77 watts per square foot.

That they find it ample for all their requirements is evidenced by the following extract from G. H. Miner, the managing director's letter: "We might say we are very much pleased with the results so far, and would not care to revert to the old system of lighting. The system seems to be very much superior in every way."

The latest ones to adopt this method are the Young Methodist Church, the Great West Life Insurance Company for their new four-story building and the Grand Trunk Pacific Railway.

FIG. I.—INDIRECT ILLUMINATION IN THE OFFICES OF THE PRUDENTIAL INSURANCE COMPANY, WINNIPEG.

FIG. 2.—R. G. DUN & CO.'S OFFICE, WINNIPEG, BY INDIRECT ILLUMINATION.

Efficiency in Lighting

Since disposing of the question "What is an illuminating engineer," the society has occupied itself to a considerable extent with a general discussion of Art vs. Efficiency in Lighting. At the last meeting of the New York section this question came in for a major part of the attention of the speakers. The architects, and certain of those among the illuminating engineering profession, are making much ado about the necessity of considering "effects" in illumination rather than cost, or as they express it, "efficiency," and are taking the whole illuminating engineering profession to task for its failure to recognize the importance of the artistic side of the lighting question. Like the "What-is-an-illuminating-engineer" discussion the argument is in general entirely futile, for the reason that it is based either upon erroneous conclusions or false premises.

Speaking of the illumination of the Soldiers' Memorial in Pittsburgh, Mr. Hornbostel, one of the architects of the building, after referring in a general way to the remarkable lighting installation, which is the chief feature of the building, said:

> "From the point of efficiency, of course, the ceiling was a failure. Of the 100 hp. represented in light units perhaps 80 per cent. of the light was wasted. We used the flaming arc, the tungsten lamp, the Moore tube and the Cooper Hewitt lamp behind the glass screens, and produced a huge luminous rug, gorgeous in coloring, yet perfectly restful in effect. It was a mass of varied light 125 ft. square, 60 ft. above the heads of the spectators."

On what does Mr. Hornbostel base his statement that, in point of efficiency, this particular lighting installation is a failure? The enumeration of the different units used is in itself a refutation of the statement, as it includes the most efficient sources of electric light now known. Furthermore, the details of the installation were figured out by Mr. Basset Jones, Jr., admittedly one of the most thoroughly scientific and competent illuminating engineers in the profession. The statement of the efficiency, or rather inefficiency, of the installation is wholly errroneous and misleading. It is evidently based upon the assumption that illumination means simply the production of a certain intensity which will fulfill a purely utilitarian purpose; but in this instance no such object was sought for or entered into the computation in the slightest degree.

The nature of the building itself characterizes it as an architectural monument, and the primary object was to render it as impressive as possible. As Dr. A. H. Elliott well remarked in his discussion, there is no reason why light and illumination should not be employed to affect the emotions as well as music or other forms of art; and this is precisely what was aimed at in the present instance. From all published accounts the effect produced more than meets all expectations, and what is more important to this discussion, it is produced by the least possible expenditure of electric current. From the engineering standpoint, therefore, this installation must be considered one of the most efficient in existence. Simply because there is a much greater quantity of light generated in this case than would be required in lighting a factory or office of the

same dimensions has nothing whatever to do with the question of the efficiency of the installation, the object of which is entirely different.

It would be difficult to cite an instance that presents a stronger proof of the service which illuminating engineering can render to architecture. A lighting effect was desired which should not only harmonize with, but glorify this architectural monument. The illuminating engineer, with his expert knowledge of all methods of producing, diffusing, coloring and distributing light, was called in for assistance. As a result advantage was taken of the peculiarities and adaptabilities of almost every modern electric lamp, fitted with the most suitable accessory for its special purpose, so as not only to produce the acme of artistic combination of lighting effects, but also to produce the general result at the minimum of expense; and if this does not constitute efficiency we should like to have an elucidation of this much abused term.

It is time that this talk about illuminating engineering being opposed to art in lighting be silenced. Neither the science nor the profession maintains any such attitude; it does contend, however, that when a given effect is desired the illuminating engineer can devise ways and means for producing such an effect in the most practical and inexpensive manner attainable in the existing state of the art.

The Advantage of Forced Attention to Lighting Units

In discussing the lighting of large areas in which dust and smoke abound, in a recent magazine article, Mr. J. R. Cravath makes a statement which is well worth a second thought: "The objection frequently urged against some types of arc lamps, which require frequent trimming, hardly holds in such places. It may be an advantage, because frequent trimming necessitates frequent cleaning, and frequent cleaning is essential to getting one's money's worth from a lighting installation in such establishments."

The lighting unit that does not absolutely require attention is more than likely not to get it. We have known actual cases in which glass globes were taken down and thrown away simply because they had become so dirty as to absorb one-half or three-quarters of the light. In commercial installations there is the natural tendency to do no more than is necessary in matters that are not directly productive, and in the case of lighting units this practice is fostered by the fact that the diminution in illumination is so gradual as not to attract immediate attention. In the home the idea is more or less prevalent that an electric lamp is a mysterious thing which it is not altogether safe to meddle with, and that a gas burner is too delicate for anything but expert attention. So, from one cause or another, glassware and reflecting surfaces are very generally neglected. Windows will be cleaned every day in many cases, where glass shades or globes will be left for months at a time simply because they do not show their soil so conspicuously as the windows.

If some one would invent a globe or reflector that would suddenly extinguish all the light when it had collected sufficient dust or soil to cut off 10 per cent. of the light he would have one of the most valuable improvements in lighting that could possibly be invented. The flat rate or excess load controller is already in successful use. Who will be the lucky man to invent an equally effective controller for cutting out installations when they have become too dirty to be efficient?

A Backward Step

When the inclosed arc lamp began to supplant its predecessor, the open arc, it brought about a marked improvement in illumination, although actually a retrograde movement so far as efficiency of light production was concerned. The open arc had been used in this country very generally with clear globes, and in many cases with no globe at all, thus producing most intense glare. The inclosed arc lamp changed this condition by reason of its inherent peculiarities; even if a clear inclosing globe were used it soon became sufficiently coated with ash and carbon particles to act as a fairly good diffuser of light, and to mask this dirty appearance, as well as to present an apparently large light-source, the lamps were at first generally provided with opalescent

inner globes, which further increased the diffusion and reduced glare.

The very great improvement in the illumination from the physiological standpoint so fully compensated for the lack of absolute efficiency, that the lamp was received by the public with general satisfaction. Thus there was unconsciously brought about a most invaluable object lesson of the value of diffusing the light from intense sources, which had a marked effect upon the use of other units, particularly the incandescent lamp.

The introduction of two new forms of units with greatly improved efficiencies has temporarily accomplished a backward step in this regard. The magnetite arc, which considerably exceeds the open carbon arc in point of intrinsic brilliancy, has been generally installed with clear glass globes. This fact, together with the practice of putting in the lamps at much more frequent intervals for spectacular effect, has so increased the glare as to make the illumination in many cases well nigh intolerable.

The other case is that of the tungsten lamp. In the anxiety to secure the saving in operating cost which this type of lamp affords, they have been very frequently put in, not only in the same locations, but into the same reflectors or glassware formerly used with the 16-c.-p. carbon lamps. Since the units are much larger, as well as more intense, the result in many cases is a general brilliancy and an exposure of bare filaments which is exceedingly disagreeable to the eyes.

This reversion to the old conditions of glaring lights is undoubtedly a backward step. Fortunately, however, it is destined soon to pass. Either the long burning flaming arc lamp, with its complete freedom from glare, will take the place of the metallic arc, or the necessity of diffusing the light of the latter will be recognized; while greater familiarity with the proper use of the tungsten lamp, and the fact that the value of illumination is measured by its effect upon the eyes, and not simply its brilliancy, will effectively reduce the misuse of this valuable improvement. These needed precautions cannot be acted upon too quickly, especially by those interested in the manufacture and sale of these new units.

The Pleased Customer as a Business Asset

The business manager of one of the largest and most successful gas companies in America, in a recent address to the employees of his company, opened with the following statements:

> "To-day the factor which contributes most to the prosperity of the gas company is the satisfied customer. By gas company, I mean the stockholders, the directors, the officers and the employees.
>
> "It is obvious that prosperity to the company means prosperity to everybody connected with the company. The biggest responsibility rests upon the individuals and the departments which come in direct contact with the public. The success or failure of their efforts towards satisfying customers directly affects the welfare of all."

The principles thus briefly stated might well be taken as the entire code of procedure for any gas company or central station. Let it be particularly noted that this code is one framed up for the strictly business purpose of promoting the welfare of the gas company, and has absolutely no altruistic or philanthropic motive; it is business policy, nothing more nor less.

There has always been, and still exists, a certain degree of suspicion, amounting often to actual contempt, for the application of the "Golden Rule" to business or politics. Of course, florid panegyrics on the beauty of commercial holiness are always in order at public gatherings, especially when newspaper reporters are in attendance; but in the actual conduct of business enterprises there are many who have a sneaking notion that all such maxims are sheer sentimentality, and who would be quite as much ashamed to admit that they had any influence in their actual dealings as they would to be caught reading a book of poems or a love letter.

"There is no friendship in business" is probably the most lying proverb ever perpetrated. The human, personal element can never be eliminated from trade so long as the purchase of goods is eliminated and executed by the human mind. One of the brilliant orators and politicians that this country has produced once inadvertently stated that the "Golden Rule" has no place in politics.

He has never been heard of since. One of the most successful mayors among our notoriously mismanaged cities secured his election and conducted his official duties on this rule alone. Stripped of the marks of its religious origin and reduced to the simpler expression, "the square deal," the public avowal of this principle gave unprecedented influence and political power to one of the most remarkable presidents this country has ever had.

Americans are preeminently a self-respecting people. Their racial descent, history, and political institutions all contribute to this invaluable human quality. They naturally despise trickery, resent charity, and love justice. Generous to a fault to the needs of the unfortunate, they ask only a fair and just treatment for themselves. It is doubtful which is the more repulsive, to receive alms, or to be tricked out of money in a business deal. The user of gas or electricity has not the slightest desire to obtain something for nothing, nor would he have an easy conscience if he knew that his bills for illuminants were being reduced at the expense of the wages or welfare of the employees of the corporation supplying them, or of reasonable dividends for those who have invested their money on the good faith of the public patronage. The only point with the customer is to assure himself that he is not being exploited to produce dividends on paper capital, or contributing to any "shell game" of high finance. The customer who will not listen to a courteous explanation of the "reason why" is so rare an individual that he can be left entirely out of the account.

The origin of all the trouble that has arisen between public service corporations and the public is failure on the part of the corporation to take the public into their confidence, and give them actual facts and data. There is no occasion for such corporations posing as public benefactors; that is not their mission. Neither are they "public servants" in the ordinary meaning of that term. The lighting companies are business corporations engaged in the manufacture and sale of illuminants, and are no more public servants than the retail merchant, or the lawyer or physician. It happens that they have to make a different use of the public streets than other business concerns, but this is simply incidental to their particular business, and not a fundamental difference. The retail merchant has to use the streets to receive and deliver his goods. The gas or electric company does precisely the same thing but in a different manner, delivering its merchandise through wires or pipes instead of by moving vehicles; and it has quite as good a claim to the right of such delivery as the smallest shopkeeper who delivers his wares with a pushcart.

Those who are afraid of being thought sentimental may rest fully assured that the pleased-customer policy is in accordance with a strictly business policy that has proven itself times without number to be not only the best, but the only basis of full success; and if they will combine the policy of the "square deal" with Lincoln's immortal axiom as to the impossibility of "fooling all the people all the time," they can be assured that if they do not attain the success hoped for, the method of application, and not these foundation principles, is at fault.

A Letter

Editor The Illuminating Engineer,
New York, N. Y.:

On page 241 of the February issue of The Illuminating Engineer there is an article to which I object very seriously.

To begin with the writer is a manufacturer of shop clusters and, I presume, was looking for some free advertising and this in spite of the fact that his shop cluster was tried out in the factory in question and discarded. Then the statement that the tests were made by the chief electrical engineer of the works is untrue.

"As the most modern representative of gas lighting the upright mantle cluster lamp, or so called 'gas arc' was chosen" is also imagination on the part of the writer of the article.

The cost of gas and electricity he has almost right, but not quite.

The tests made under shop clusters (which were not made by this manufacturer) were made with an entire floor lighted and the gas illumination readings were made with only one bay lighted—a

slight matter of some 40 per cent. in a comparative test.

No readings under the gas arcs have ever been made in this plant with a full floor lighted.

The electric lamps were hung 5′ 6″ from working plane and the gas arc lamps 6′ 6″, which would require still further adjustment before comparisons could be made.

We have taken readings in the room in question and a similar room lighted with shop clusters.

Each room had a floor area of 15,472 ft. There were 74 4-light, 60-watt tungsten clusters in the room and showed a draw of 11,840 watts, with an average candle-power, at 2 ft. 6 in. from the floor, of 3.865.

The same area had 46 3-light inverted Humphrey gas arc lamps with quarter ground globes, but no reflector. The gas consumption was 500 cu. ft. per hour and the average was 4.188 foot-candle.

The maintenance cost given for tungstens is purely an estimate based on a supposition of 1200 lamp hours life and no labor cost included.

I wish to mention that this manufacturer had a pamphlet printed in which he used the name of the chief electrical engineer of these works and said engineer had to threaten libel suit to get them suppressed.

I request that this letter be published that my fellow readers who like to believe what they read in THE ILLUMINATING ENGINEER may not be misled.

This has the approval of the chief electrical engineer of the automobile works of which the article professes to treat.

Very truly yours,

FRANK S. FUGATE,

Illuminating Engineer, Detroit City Gas Company, Detroit, Mich.

Notes and Comments

The Public Demand for More and Better Light Continues Unabated

THE FLAMING ARC LAMP MEETS WITH APPROVAL—KANSAS CITY, MO. COMMITTEE ON DECORATIVE LIGHTING FAVORS THIS SYSTEM

Decorative street lighting is now in use in so many different towns of all sizes that those who are still in the dark have the advantage of this wide experience in choosing a method for their use. It is common practice—and a wise one—for those promoting or entrusted with the installation of such lighting to visit different cities having installations of the several types of lamps available in order to make an intelligent choice for their own town. A similar method of investigation has been pursued in Kansas City, and has resulted in the choice of the flaming arc, according to the *Post:*

"In order to obtain appropriate downtown street lighting the Mayor's cabinet this morning determined to ask the Commercial Club to begin an educational campaign to show the people how advantageous proper downtown lighting methods are.

"Mayor Brown, acting on his cabinet's advice, will write a letter to the Commercial Club, asking it to have a meeting to which it will invite members of the Kansas City Ad Club, officers of the Kansas City Electric Light Company and members of the light committees of both houses of the Council.

"After receiving reports from many cities which use ornamental downtown street lighting the committee has practically agreed on the style of flaming arc lights as being the most fitting for Kansas City.

"The installation of these lights, it was proposed, should be borne by the adjoining property owners, but at the end of the first year the city should bear a certain part of the maintenance."

A NEW USE FOR THE RED LIGHT—TO BE USED AS A GENERAL POLICE CALL

A novel use of the red light as a signal is proposed by the Chief of Police of Rome, N. Y. The scheme is at least ingenious and seems to have many features of real merit. It would appear to be specially serviceable in the more sparsely settled sections of cities, where each patrol-

man has to cover a correspondingly large beat and is therefore difficult to reach in case of an emergency. The following account of the plan is given in the *Sentinel:*

"At the last meeting of the Board of Fire and Police Commissioners, Fire Chief Briggs exhibited and explained the workings of an electric light apparatus which he had designed for the use of the Police Department. By means of this apparatus and the erection of the necessary wiring red lights may be shown at any points in the city by simply throwing a switch on the desk in the police station. The red light is designed as an emergency call, summoning any policeman who sees it to the nearest signal box for instructions from the police station."

UNIFORMITY IN PUBLIC LIGHTING—ITS DESIRABILITY IS URGED IN DIFFERENT CITIES

The prevailing practice of Merchants' associations installing decorative lighting systems on different streets or sections of the city offers possibilities for serious discord in the matter of the general appearance of both the fixtures and the illumination. This possibility is being recognized in many instances and provisions made to forestall it.

Referring to the proposed use of flaming arcs in Kansas City, those promoting the new lighting have suggested that the Council pass an ordinance specifying one kind of light and requiring all installations to conform to the unit and fixture selected. A still further step toward uniformity comes from Johnstown, N. Y., where it is proposed to extend it to the store window lighting. The suggestion as reported in the *Republican* is a good one:

"Some little discussion was had [by the Board of Trade] regarding the problem of lighting up Main street somewhat better in the evening, and the suggestion was made that a systematic effort be inaugurated to have the merchants adopt a uniform plan of store window illumination, using a sufficient number of the new tungsten lamps to give their places of business a brilliant appearance and thus combine the two results of showing off their goods to the best advantage and giving the town a wide awake aspect on evenings when the stores are closed, instead of having it look a 'Deserted Village.' Some of the merchants who appreciate that fact that next to newspaper advertising there is nothing that so calls attention to their goods as brilliant illumination, have already adopted this plan with splendid results, and it is believed that every storekeeper in the city will soon realize that trying to save light is false economy and fall in line with the progressive movement."

TO MAKE LIFE STILL MORE WORTH LIVING—DETROIT TO BE ANOTHER "BEST LIGHTED CITY IN THE WORLD"

We have sometimes advanced the theory as an argument against municipal ownership of lighting plants that the incentive of private gain would be lacking in promoting the use of light. Detroit is apparently intent upon proving the contrary. This city has probably the most successful municipal electric lighting plant in this country. It claims to be furnishing the city with arc lamps at a cost of $30 a year. The Commission, having the plant in charge, is not satisfied with this record, but wishes to go further and make the city, to use their own phrase, "the best lighted city in the world," according to the *Journal:*

"The Commission announces that it has reduced the cost of maintenance of street lamps from $31.50 to $30 apiece, a great achievement in public lighting and one that sets Detroit in the front rank for economical service.

"At the same time, in keeping with a plan to make Detroit the best lighted city in the United States, the Commission asks for 600 additional lamps to be placed on two main thoroughfares and in the wards.

"The request for 600 new lights, in addition to the 4,737 now in service, is in line with Detroit's urgent needs for still better lighted thoroughfares and cross streets.

"These new lights are the forerunners of others that will follow in later years, to be spread over the city, making Grand River avenue, Fort street, Gratiot and every other big street thoroughly well lighted."

HERE AND THERE

WILMINGTON, DEL.—A meeting having been called by the mercantile committee of the Board of Trade through an invitation sent to Market street merchants, to hear discussion on the illumination of Market street, a large and representative gathering, including members of the Street and Sewer Department, representatives from the Wilmington & Philadelphia Traction Co. and the Wilmington Gas Company, as well as a large number of the merchants, were present. The general trend of the discussions seemed to be that the merchants want better illumination on this main thoroughfare and in most cases are willing to pay for the decorative lighting current, but the details of how the cost shall be divided is a matter which yet remains to be worked out.—*Every Evening.*

FORT WORTH, TEXAS.—All incandescent street lights will be replaced by tungsten lamps under the proposed lighting improvements provided for in the $50,000 worth of bonds voted January 13. The present arc light equipment will be increased by more than half. There are now approximately 700 incandescent street lamps. By the installation of the street tungstens it is expected to double the present lighting effect.—*Telegram.*

LODI, CAL.—At the meeting of the Merchants' Association A. V. Friedberger, W. H. Thompson and S. H. Zimmerman were appointed a committee to interview the business men of this city regarding the proposed street lighting system which is to beautify the principal business streets of Lodi.

The city trustees have expressed a willingness to see that the lights are kept burning each evening for all time to come, providing the business men will pay for the fixtures. The fixtures that will probably be purchased are the cast iron frame cluster electrolier patterns, now coming into use in all the large cities.

The committee will first ascertain what the fixtures will cost, then by canvassing the business section will be able to find out how many of the fixtures can be purchased.—*Sacramento Union.*

MINNEAPOLIS, MINN.—An immediate extension of the ornamental street lighting system along Tenth street, from Nicollet to Fourth avenue, will be urged by property owners along the street. The innovation is in connection with the improvements along Tenth that real estate men say will cause a divergence of business from Nicollet avenue along Tenth.—*Tribune.*

DUBUQUE, IOWA.—Ornamental curb lighting is a matter in which Dubuque has not kept up with the procession. The boulevard lights freely employed elsewhere for ornamental and advertising purposes are shown here in only a few places. Des Moines, Sioux City, Davenport, Cedar Rapids, Waterloo, Albia and many other towns have them. The Capital City has over 300 in use at the present time. The merchants in one block used them and their neighbors soon realized that they could not do without them. They give the business district a brilliant appearance at night.

JOPLIN, MO.—The Commercial Club listened last night to a proposition for better lighting for the business section of the city, under which a very effective three or five burner street lamp can be introduced as a substitute for the present arc lights, at no increase of outlay, after they have been once installed.

Mr. Miller of the Empire Light & Power Company explained the proposition and its advantages and popularity in other cities where it has been introduced. He asked for the co-operation of the club in bringing the matter before the business men and owners of business property.

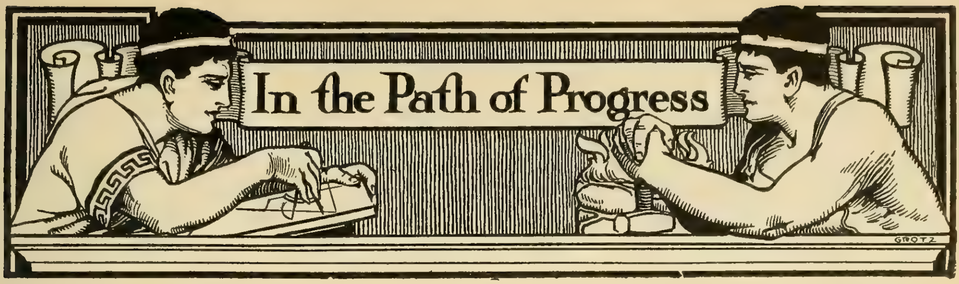
The matter was discussed by several members, who emphasized the need of more advertising of this character, and some of the speakers also criticized the lack of enterprise on the part of owners of business property in failing to bring store fronts up to the level of modern improvements.—*Globe.*

PHILADELPHIA, PA.—Inspiring plans for the development of Market street from the Delaware River to Sixty-ninth street, within a short time, and eventually on through Delaware and Chester counties to West Chester, making it the greatest business street in the world, were discussed at a preliminary meeting held last Friday night in Boyer's Hall, Market street, near Fifty-second street. These improvements would make Market street one of the greatest business streets in the world, and it is the thought of those at the meeting that it would be continued in the future Greater Philadelphia on past Millbourne, Llanerch and to West Chester in the same manner as New Yorkers speak of Broadway running continuously to Albany. For many years this will be the only continuous business street the entire length or breadth of Philadelphia. —*Bulletin.*

DULUTH, MINN.—Business men of the West End will again revive the "White Way" lighting system, which has remained quiet for the past three months. It is proposed to bring the matter to a head at the next meeting of the Commercial Club.

A large number of the business men have signified their intention of placing standards in front of their places of business if no regular system can be agreed on.—*News-Tribune.*

REDLANDS, CAL.—The city trustees met Wednesday afternoon and transacted much routine business and received drawings by Engineer Hinckley of the proposed ornamental street lighting system and ordered plans and specifications prepared. The drawings of Mr. Hinckley call for a system of ornamental lights throughout the business section, doing away with the arcs and incandescents now used there.—*Review.*



General Progress During the Past Year

In order to obtain a general review of the year's progress in the lighting field a letter of inquiry was sent to a number of representative manufacturers, central station and gas companies. The following replies have been received:

From H. M. Slauson, Sales Manager, The Opalux Company, New York:

The Opalux Company started last October with a new line of reflectors. Popular demand had necessitated increasing the styles and sizes, and with the new acquisition of wide, medium and narrow types, adaptable for all sizes of lamps, phenomenal returns have resulted.

"The Glass Without the Glare" has found its way into many of the largest buildings in the country. The name "Opalux" has ever been before the reader through trade journal advertising, which to a large measure has contributed to its success.

To-day we feel that every architect, engineer, fixture manufacturer and dealer is well acquainted with this product, and that due consideration is given to its merit when lighting problems are presented.

Probably no glassware is better fitted to meet general conditions, which is undoubtedly realized by its popularity; it must be seen to be appreciated.

From W. S. Kilmer, Lighting Engineering Division, H. W. Johns-Manville Company, Electrical Department, New York:

The past twelve months comprise a period of great activity both from a sales and engineering standpoint for Linolite, the lighting product of this company.

One of the most prominent and forward steps in this direction has been the organization of the Lighting Engineering Division, whose first steps were to compile reliable photometric and illumination data for illuminating engineers, architects and our own staff of salesmen, and endeavor to check the abuse to which Linolite has been subjected owing to lack of this information, pertaining to our large line of accessories which comprise the Linolite system of illumination.

Our constant increase of satisfied customers shows us that the Lighting Engineering Division has passed from the experimental stage to the finally established fact, filling a long felt want.

We are now furnishing our lamp in three sizes—namely, 16 c.-p., 50-watt, carbon; 20-c.-p., 25-watt and 28-c.-p., 35-watt, tungsten, and with our present line of reflectors are specializing in the fields of show case, cabinet and window lighting, type rack and indirect lighting systems, desk and table lighting with portables and other special fields where the lamp fills a long felt want owing to its adaptability as a space saver.

Prospects for the coming year are very bright, and we are broadening our field with new units designed for the use to which they are recommended.

Our new catalogue, now ready for distribution, shows the steps which have been taken along this line.

From S. B. Stewart, General Contracting Agent, Consolidated Gas Company of the City of Pittsburg:

For about four years our company has

specialized on commercial lighting by means of the upright and inverted types of arc lamps. We have made considerable progress and feel that the proposition of commercial lighting has been a good thing for the company.

During 1910 we made serious efforts to improve the lighting facilities for our consumers who use gas for residence lighting. Although we are not in a position yet to say how much we have gained by this operation, yet we feel that considerable progress has been made.

The new improvements in arc lamps and smaller unit types for residence purposes have been of great value in assisting to solve the problem of satisfactory and economical lighting for every one.

From A. C. Dunham, President, The Hartford Electric Light Company, Hartford, Conn.:

We have made very great progress in household lighting during the past year by the use of low voltage tungsten lamps, in connection with a contract system. This plan has turned out in our case with a good degree of success. We have increased our incandescent lamp purchases from $40,000 to $72,000, this embracing the purchase of all the various kinds of incandescent lamps which we have in use, but most of this increase has been in the 15-watt, 11-c.-p., 60-volt lamp and the 25-watt, 20-c.-p., 60-volt lamp employed in house lighting. We have found this low voltage lamp has a life of approximately 2000 hours, and is quite tough from its having a short filament and a larger diameter than the 120-volt lamp.

By this method, we have doubled our house lighting business in three years, most of this increase having been obtained during the past year. We have been able to discard the use of the meter in house lighting business to a very large extent and at the present time are entirely satisfied with this experiment in this branch of our business, so much so, that we intend to continue it to its full capacity.

Now that the price of meters is getting lower, we shall begin to purchase some to use in connection with a certain class of lighting. We have not purchased any meters for the past three years, except some few for power purposes only. This is the most important phase of our lighting business that we can give you, and we see no reason now why house lighting in connection with a good system of cooking by electricity cannot very rapidly occupy a very large field.

A most interesting phase of this experiment with us has been that with this system we are able to serve the middle and even poorer classes of citizens—in fact, we are now lighting tenement houses to a considerable extent, which are occupied by Italian and other workmen earning comparatively small wages.

From E. W. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.:

There has been nothing particularly new or startling in connection with the growth of the electric lighting business in this community. Tungsten and tantalum lamps seem to be used very universally in the business territory and are gradually obtaining a foothold in the residence districts.

There have been a large number of different forms of arc lamps put on the market in the past year or two, and these different makes of lamps are being exploited in Chicago with more or less success. Most of these new forms of arc lamps are still in the development stage, but there seems to be a possibility that these lamps will be of considerable aid in securing more customers for the use of electric light.

We believe illuminating engineering applied in a practical way is a considerable help in satisfying customers and getting some new business. We sent six delegates to the Baltimore Convention and feel that these men are the better for having attended.

Taking everything into consideration, we had a very satisfactory year considering general business conditions. Our net increase in connected 50-watt equivalents being 1,060,000. The only thing that is new with the Chicago company is the putting out of street posts in outlying business districts. We have signed up contracts for about 1800 of these posts during the past year and believe that we will do more business than this during the coming year. These posts have been in-

strumental in improving the lighting conditions of the streets where they were installed and have attracted a great deal of attention from other business districts.

We have a large number of inquiries from these people and we are now endeavoring to persuade these prospects to use this form of street illumination, which consists of either one, four or five tungsten lamps per post.

From J. Vanden Bout, Superintendent New Business, Williamsport Gas Company, Williamsport, Pa.:

Since the new style of inverted lamps and accessories have been in use here, we have been able to obtain considerable new business, both indoor and outdoor.

I believe these lamps are as far superior to the old upright lamps as are the tungsten filament over the carbon filament lamps.

These new lamps have cracked open an entire new field for commercial lighting.

In regard to Gas White Way movements you inquire about, I am submitting a photograph of one of these White Ways in our city. This photograph shows one block lighted with Humphrey Outdoor Arcs, twenty-six in number. There are a number of lamps in this block now, however, installed since the photograph was taken. This photograph shows the beginning of our White Way.

We have two other blocks contracted for to be lighted in the same manner, one of which is already installed.

These lamps are operated on a flat rate basis, lamps being lighted at dusk and burning until 11 o'clock.

From E. R. Davenport, Sales Manager, Narragansett Electric Lighting Company, Providence, R. I.:

The lighting industry in Providence during the past two years and more especially during the year just closed has indeed been very satisfactory, and the results accomplished have been particularly gratifying. In fact, both years might be termed years of reconstruction.

There has been a gradual, yet constant,

THE GAS WHITE WAY, WILLIAMSPORT, PA.

movement toward the elimination of poorly arranged and inefficient installations, and an ever increasing tendency toward a higher standard of illumination; a gradual awakening to a full realization of the fact that a scientific installation of lights properly equipped is of value from an economical as well as from an esthetic standpoint.

These results have, in great measure, been accomplished, I feel, because of the unceasing campaign of education for "More and Better Lighting" waged throughout the electrical fraternity by the allied lamp companies and the various reflector manufacturers, not overlooking the herculean efforts of the ILLUMINATING ENGINEER and kindred trade papers.

The wisdom of such an endeavor to instruct and improve is to my mind becoming each day more manifest. While the vast majority of installations are today planned independent of advice from the lighting companies, they nevertheless show when completed that the "old order changeth" and that now an installation is planned with a view to appearance, to economy, and with some little regard for the purpose to be accomplished.

We anticipate a large increase in business and a still further improvement in conditions during the present year.

FROM I. B. ZIMMAN, CONTRACT AGENT, OMAHA ELECTRIC LIGHT & POWER COMPANY, OMAHA:

The progress made during the past year is highly gratifying to us. A large share of our gains in connected business and output in energy is due to a considerable extent to the wonderful improvement made possible in illumination by reason of the part the new lamps are playing, which really means a great improvement in the standard of illumination.

Many notable installations in our city represent consumers who formerly used carbon lamps, inclosed arcs especially, with comparatively little satisfaction, and are now enthusiastic Mazda lamp users because we are now furnishing them a higher standard of illumination with practically no increase in cost, after taking account of lamp renewals. The new lamps enable us to take on store lighting business that could not have been reached with the old style lamps.

In the residential district the high efficiency lamps are not so generally used, but the educational campaigns regarding low cost for lighting carried on by manufacturers and ourselves undoubtedly stimulated a desire for electric lighting, so that practically ninety per cent. of all new houses built are wired and connected. We also connected 1227 already built houses during the year. We have in all about 30,000 homes in our city, and when taking into consideration the gain of about 2900 lighting customers, out of which number 1227 are old houses formerly using other forms of lighting, it is indeed gratifying.

As to the illuminating engineering feature I wish to say that in my opinion that branch of the business should contribute in a material way to the success of a central station, and the inauguration of such a department should be encouraged wherever local conditions warrant it. In our city we have not as yet reached that stage, but we hope to in the very near future. In the meantime installations that call for illuminating engineering are not at all neglected.

Regarding white way movements and spectacular outdoor lighting, wish to say that we now have a bill before the Legislature that contemplates the creation of special lighting districts in cities of metropolitan class that will undoubtedly be passed, after which we will undoubtedly have a great white way comprising one hundred city blocks. At the present time our outdoor lighting consists altogether of several hundred flat rate and metered electric signs.

FROM O. M. RAU, SUPERINTENDENT ELECTRIC LIGHTING, THE MILWAUKEE ELECTRIC RY. & LT. COMPANY, MILWAUKEE, WIS.:

The most noticeable advancement has been the general application and successful installation of the large unit tungsten lights, which are fast superseding the Nernst lamp as well as the tungsten cluster. A movement toward decorative street lighting received considerable encouragement, and I herewith inclose photographs of two methods which have

ORNAMENTAL LIGHTING, MILWAUKEE, SHOWING TYPE OF FIXTURE USED IN OUTLYING DISTRICTS.

been adopted in the outlying districts, where economy is necessary—arc lights on a plain or cheap standard have been adopted. While in the downtown district where a more expensive plan could be installed ornamental five-light tungsten clusters with five 100-watt lamps are used. A very marked improvement in the method and care with which lighting installations have been made during the past year is apparent which is directly accountable by the number of consulting engineers specializing on illuminating engineering.

From J. W. Hancock, General Manager, Roanoke Railway and Electric Company, Roanoke, Va.:

The most marked progress in the lighting situation in our territory during the past year was the very large increase in the use of Mazda lamps, the number in service at the close of the year being approximately double the number at the beginning of 1910. The improvements that have been made in these lamps by the manufacturers have in my opinion had much to do with their wider use. I believe these lamps have now passed the experimental stage, and that in a comparatively short time their use will be almost universal.

The introduction of Mazda lamps on an extensive scale has not caused any reduction in our revenue. We find that by reason of the economy of these lamps, the customer installs more units, and burns them longer hours.

We sell Mazda lamps at about 10 per cent. above net cost. There has been a noticeable decrease in the cost of free renewals of carbon lamps, due to the introduction of the new type lamps.

The recent progress in illuminating engineering has been of much value to us in expanding our lighting business. In the better part of the business district of our city, much progress has been made in the installation of modern methods of illumination in store windows. This and

the erection of a large number of electric signs has made a noticeable improvement in the general lighting of our streets.

From Ewald Haase, Secretary and Treasurer, Milwaukee Gas Light Company, Milwaukee:

We can report distinct progress in gas lighting in our community in a number of fields.

The lighting of store fronts by means of outdoor arc lamps on brackets was extended and improved. The substitution of the inverted gas arc lamp in place of the upright produced considerably more illumination at no increase in cost. This combination of window and street illumination retains its attractiveness to a great many merchants.

Store lighting has required considerable work in the way of improved installations. The mistakes of former years had to be rectified by better location of units and by changing to the proper size of units.

The lighting of factories has received much attention and has been greatly extended. In this field, perhaps more than in any other, it has been necessary to study carefully the kind of units to use and the location of such units. The large unit of the inverted gas arc lamp is found the most practical for lighting of large areas, while the small units of inverted lamps with appropriate glassware are used to accomplish the illumination for knitting machines, and sewing machines in knitting factories and tailor shops and shoe factories, for the lighting of individual machines in machine shops, the lighting of all kinds of bench work in glove factories, candy factories, bookbinding and ruling shops and printing offices.

Another application of the proper lighting methods has secured a large proportion of the bowling alley lighting in the city. The largest and best equipped league alleys in the city are lighted by gas, the installation including pneumatic control for the lighting of each set of two alleys.

Billiard and pool table lighting is another phase of gas lighting that has been developed successfully in the last year.

In all of the above fields of lighting there have been occasional applications of electric control of gas valves in both gas arc lamps and Reflex lamps. In house lighting, electric and pneumatic control

ORNAMENTAL LIGHTING, MILWAUKEE, SHOWING TYPE OF FIXTURE USED IN BUSINESS SECTION.

of fixtures has made lighting more convenient and has, to a limited extent, found application.

Illuminating engineering literature has been of value and its data have been used as a guide, but also much of the work has been accomplished by experiment and trial by which standard methods were developed.

From H. H. Geary, Treasurer and Manager, The Fostoria Incandescent Lamp Company, Fostoria, Ohio:

The effects of the work of those who have been active in scientific illumination, among whom The Illuminating Engineer has been a leader, have been most apparent to us as lamp manufacturers during the past year.

Haphazard methods of illumination are things of the past, and the results of definitely calculated and designed lighting are apparent on all sides. This is not only true in the case of public places, such as stores, hotels, etc., but also in the industrial plant and the home. Of course, the field is large and there is much more cultivating to be done, but that which has already been done has given such remarkable effects that what remains to be done will be relatively easy—in fact, almost automatic, so long as the work of the pioneers of illuminating engineering continues active.

Up to two years ago it was quite noticeable that a very large percentage of lamp purchasers were overly ambitious to have extremely high economy lamps—in many cases higher than their voltage regulation would warrant. In placing their orders great stress was given to the high efficiency of lamp that was required, and yet if you were to follow these lamps to the sockets you would find in ninety per cent. of the cases they were used with absolutely no regard to scientific or commercial lighting service and as a result the actual economy of the lamp itself was lost.

There is no doubt but what The Illuminating Engineer has been the source of great benefit to both the consumer and maker of lighting material and as such all should be thankful to it.

From H. R. Hooker, Secretary and Treasurer, The Dayton Gas Company, Dayton, Ohio:

So far as our particular situation is concerned, the year's progress has been very satisfactory indeed.

For general commercial purposes we have continued to push the four burner upright arc lamp. This lamp we have found to stand up better under varying conditions of pressure, etc., than its rival, the inverted arc. It is unquestionably without a peer as to effectiveness and economy for general store, factory or office illumination. The past year has shown an increased demand for this type of lamp. It has more than met the competition of the lately introduced "Tungsten" Electric lamp and its old rival, the "Electric Arc," is no longer in competition with it at all.

In the residence lighting field we have continued to push the individual inverted burner, and in addition to this have paid some attention to the flat flame burner business, as there are numberless places where lights are used but a short time that flat flame burners are preferred. We sent out notices attached to gas bills advising customers that if they would take off their old burners and bring them to our office when paying their bills we would exchange them for new modern burners. This we found met with decidedly popular favor, as the response was very general.

The past year in street lighting has been very active indeed with us, as the City of Dayton advertised for a new lighting contract for ten years. We secured the contract and installed some 1600 lamps of the Boulevard pattern, which we had built specially for us. The lamps are equipped with single upright mantle burners and have proved very satisfactory indeed.

In window lighting we have developed quite a considerable field. One very popular form of installation being to fit an inverted cluster lamp with bowl shaped shade in an opening in top of window casing so that only the glass bowl shows from below. This makes a very attractive and efficient installation indeed.

The Illuminating Engineer has

helped our New Business Department very materially with suggestions of attractive window and interior lighting schemes, several of which suggestions have been developed and proven very attractive.

From Milan R. Bump, Treasurer and General Manager, The Empire District Electric Company, Joplin, Mo.:

During the year 1910, we have introduced tungsten illumination of various types with excellent results. For many classes of long-hour consumers, we find that the flat rate basis has proven attractive and satisfactory. This taken in connection with an installment plan for selling fixtures has proven very popular with saloons, restaurants and other long-hour consumers. We have also had complete success with the tungsten sign and have been able to sell more than 100 signs as the result of our first year's new business effort. During the year we secured a contract for the complete lighting and power service of the new department store of the Newman Mercantile Company, which is a six-story building, approximately 100 feet square, and this building is lighted throughout with two and four lamp tungsten fixtures, most of which are filled with 100-watt lamps. The results from this illumination have been very satisfactory and have been the means of inducing many of our merchants to raise the standard of their illumination to conform with this new standard.

The outlook for the year 1911 is very promising, and it is our expectation that the revenue for the year will show an increase of more than 30 per cent. over 1910.

From E. J. Kulas, President, The Tungstolier Company, Cleveland:

In my opinion the fathers of scientific illumination should feel much encouraged as a result of the development along these lines in the past twelve months. I believe that the consumer is making far greater demands now for fixtures, scientifically constructed for illuminating results, than ever before. It is no longer a case of buying so much brass, but buying a lighting unit that will produce the best lighting results.

I firmly believe that the year 1911 will even emphasize more decidedly the demand for methods of lighting that are scientific and to those in the business of lighting supplies this means increased business. As it has in the past year, the old installations of incorrect illumination are giving way to improved methods, which means more business for all of us.

From T. J. Rider, Jr., Secretary, Sunbeam Incandescent Lamp Company, Chicago:

We consider ourselves pretty close to our customers, hence are familiar with operating conditions and our customers' requirements, and we also are as well advanced and up-to-date in the manufacture of the various types of lamps on the market, and especially the higher efficiency styles, as anyone else is. In our judgment there will not be any radical changes, so far as the efficiency of the various types of lamps now in use is concerned, but there will be quite a few improvements in construction in the present styles of incandescent lamps now on the market. Incandescent lamps of all kinds are fast replacing other forms of illuminants. Mazda lamps can now be obtained for commercial circuits in candle powers as low as two and as high as 400. One reason for the big increase in the use of incandescents the past year is due to the fact that there is not a lighting installation in use to-day, which has been in use seven or eight years, that is not obsolete, or rather out of date, although the lamps may be in good operating condition. Economy demands that they be replaced by more efficient illuminants. Light users therefore have been impressed by the fact that the permanent parts of an incandescent lamp installation, particularly those adapted for Mazda lighting, judging from past experiences and present indications, will not become obsolete for the reason that, should any higher efficiency types of illuminant be produced, they will be without doubt put out in the present form of incandescent lamps and therefore

there is no likelihood of there being any loss due to the replacement of the permanent parts of a Mazda installation by a new form of illuminant. The fact that Mazda lamps will, no doubt, in the near future be manufactured with more durable filaments will mean a material increase in the number of Mazda installations the coming year. As a conservative estimate we predict an increase of from 25 to 30 per cent. over 1910 in dollars and cents in the lamp business of the United States.

From W. H. Spencer, Engineer, I. P. Frink, New York:

The past year has been one of our best, and indications are exceedingly favorable for 1911.

We find architects and engineers are giving more attention to illumination as one of the principal features of modern buildings. The old song entitled "Watts per square foot" sounds like a discord to the up-to-date architects, who are beginning to realize the possibilities in light as an important factor in architectural design and decoration.

From E. R. Lewis, National Gas Light Company, Kalamazoo, Mich.:

We are pleased to report that our progress during the past year has been most satisfactory both from a construction standpoint and a sales standpoint.

One year ago we were supplying inside arcs only, mostly five-mantle with a few four-mantle. These we are now supplying with an improved burnerhead, pilot and air shutter, and consider the 1911 model, as we are now shipping it, standardized.

We have added to our list the two and three mantle inside arc, so that we are now supplying inside arcs in two, three, four and five mantle sizes interchangeable and have also perfected and added to our list an outside arc in two, three, four and five mantle sizes interchangeable, on which we will begin stock shipments this month.

As our sales on the inside arcs have steadily increased we expect with the added business on the outside arc to materially increase our sales for the year 1911.

Judging from the insistent demands we are receiving for the outside arc, the time is ripe for a practical outside arc, wind and rain proof, that will reduce globe and mantle breakage to a minimum.

From H. C. Marquardt, Commercial Department, Rochester Railway and Light Company, Rochester, N. Y.:

We are pleased to say the progress in "Better and Brighter Illumination" in the past year has been rapid. To assist us to successfully accomplish this we of course owe a great deal to the rapid strides taken in the introduction of more efficient illuminants combined with improved types of light directing reflectors and shades capable of subduing the intense brilliancy; and still show no appreciable loss of efficiency.

The interest of the consumer is easily aroused and attention assured when presented with the argument of "Better Illumination" installed in a modern way to insure equal distribution and desired results. This first step taken, the question of "More Illumination" will come of its own accord. We have obtained results from a campaign in educating the consumer to cater to the after-dark public by making his own place of business "a bright spot," as a medium in advertising his goods to the passer-by. Where formerly the closing hour of business meant the switching off of all lighting we now have him interested to the point where an evening's burning of his window lighting, electric sign or outline is a cheap means of advertising.

We have also succeeded in encouraging the electric wiring contractor to co-operate with the commercial staff, who, in turn, aid the contractor in every possible way by demonstrating to the prospective any new methods of lighting. In this way the replacing and improving of obsolete methods of lighting has advanced wonderfully, giving us as well as the merchant and others results to be proud of and insuring a well satisfied consumer who proves our best advertiser.

We believe the introduction of the two large sizes of Mazda units to be a very good thing, aiding us to obtain classes of business heretofore holding back, due to increased maintenance resulting from the installing of a numerous number of units.

Our newspaper advertisements have attracted and caused great comment, in the end bringing returns obtainable in no other way.

The strides taken in the improved lighting the last year have shown to churches and schools the possibilities to be attained. This class of business, although small, as compared with mercantile trade, we notice has taken every advantage in the last year to improve existing installations and in many cases a complete revising of their lighting scheme.

Our community we are quite sure are grasping every opportunity for "More and Better Lighting."

From Theo. K. Jackson, General Manager, Mobile Electric Company, Mobile, Ala.:

The year in Mobile, Ala., has shown a healthy growth in electric lighting, the receipts of the company having increased during that period $23,500. The effect of the tungsten lamp has been both marked and beneficial. The character of illumination in the stores has undergone a considerable change, a great deal more lighting being employed than before the advent of the tungsten lamp. The stores in consequence look better, brighter and cleaner, and the expense to the merchant is but little greater than it was under the old form of illumination. The tungsten lamp has further enabled us to reach a class of business heretofore largely held by the gas company with whom we are in competition—that is to say, the field of small store lighting. This has been favorably reflected in our revenue. A campaign was conducted for forty-five days looking to the wiring of old residences of the cottage type. Arrangements were made with local contractors whereby these contractors did the wiring at cost, this company paying them a profit of from $1.50 to $2.50 per job, depending upon the size of the job contracted for. This company carried on the campaign of advertising and furnished the solicitation, with the result that during the forty-five days campaign contracts were secured for wiring 664 old houses.

The wiring proposition consisted of three propositions, being as follows:

Proposition A. Complete wiring for five-room house—five drop cords, five ornamental glass shades, five incandescent lamps. This will supply lighting for parlor or living room, dining room, kitchen, and two bedrooms.

Wiring complete with lamps......	$8.00
Underwriters' inspection fee......	1.00
	$9.00

Proposition B. Complete wiring for five-room house—two two-light fixtures; three drop cords; six ornamental glass shades; seven incandescent lamps. This installation will give two lights in the living room and two lights in the dining room, one in each of the others.

Wiring complete with lamps....	$10.75
Underwriters' inspection fee.....	1.50
	$12.25

Proposition C. Complete wiring for five-room house—square brass tubing fixtures, instead of drop cords; wall fixtures where desired; two fixtures have two lights each, the others one. Shades richly ornamented. This gives a really artistic installation of seven lights, the lamps being included in price.

Wiring complete with lamps.....	$12.50
Underwriters' inspection fee.....	1.50
	$14.00

From A. Larney, Manager New Business Department, Oklahoma Gas & Electric Company, Oklahoma City:

There are many developments in this section of the country which will probably be interesting to you.

As you know, Oklahoma City is the result of a *run* by pioneers from the Oklahoma borders, when this Indian reservation was opened up by the Government twenty-one years ago.

Following five or six years, it was nothing more or less than a hamlet, but during the past fifteen years, remarkable strides have been made in building a

metropolitan city. To-day we have 70,000 people, several twelve and fifteen story sky-scrapers, three twelve-story hotels, asphalt streets everywhere, even out into the country districts, twelve hundred automobiles, one hundred and seventy-five electric vehicles and one of the most progressive cities in the Union.

Speaking of the local lighting company, we added a new unit every year, always under the impression that we were providing capacity for four or five years to come, and in every instance the unit has been practically loaded by the time it was installed.

We have made seven separate and distinct additions to our plant in seven years. The plant is now seven times as large as it was seven years ago, now having a total capacity of 7650 kw.

From V. R. Lansingh, General Manager, Holophane Company, Newark, Ohio:

From the standpoint of the Holophane Company, the year 1910 witnessed a considerable advance in many different lines. A considerable percentage of the time of our Engineering Department was devoted to research work in connection with different aspects of the subject of illumination. Perhaps the most important part of this work was that devoted to glare. This work was fairly well completed, resulting in a complete revision of ideas on the subject of glare, and also in the production of a street lighting unit which promises to be revolutionary in its effects.

A large number of improvements were made in the Holophane product during the year. Among these may be mentioned the substitution of the stiletto prism reflectors for the merged prism type, marking the highest efficiency yet attained in prismatic glassware; the production of new steel reflectors averaging 31 per cent. more efficiency than the older types, being the most efficient steel reflectors built; the production of a residence line of glassware combining decorative appearance with good efficiency.

These, with numerous less important developments, have marked a year of great activities in the Holophane business.

We look to the year 1911 for still further and greater developments.

From T. I. Jones, General Sales Agent, Edison Electric Illuminating Company of Brooklyn, Brooklyn, N. Y.:

The past year's progress in lighting in this community has been to us most satisfactory.

Our total installation among our consumers now exceeds the 2,000,000 lamp equivalent mark and much has been done toward the advancement of illuminating engineering principles in store and residence lighting throughout the city.

Aside from the general advancement among our smaller consumers, three results stand out as prominent accomplishments during the year 1910.

1. The improvement in our park lighting.

2. The use of higher efficiency arc lighting in construction work throughout the city.

3. The introduction of the decorative street lighting post in Brooklyn.

Under the first one of these three headings it will be of interest to you to know that more than 300 old type gasoline lamps which lighted Prospect Park, Brooklyn, have now been replaced by 450 electric lamps each burning 85-watt tungsten units; 350 more lamps will be added to the park within the next three months, making a grand total of 750 80-watt tungsten units compared to 300 gas mantle burners.

This is the second park changed to electric lighting in Brooklyn, Fort Greene Park having been changed in 1909.

Under the second heading it is of interest to note that during the year 1910 the new dry dock at the Navy Yard in Brooklyn was constructed not only because of the use of electric power in the operation of air compressors, but because of the operation of flaming arc lamps throughout the entire excavation by night, making the work possible throughout twenty-four hours of the day.

This use of the flaming arc lamp was most satisfactory and has been adopted throughout Brooklyn wherever night work in excavating is necessary.

Under the third heading The Illuminating Engineer has already printed an article upon the introduction of the deco-

rative street lighting post in Brooklyn.

Within the past six months the five-light type of post containing five 100-watt tungsten lamps has been introduced on our streets, and the interest has been so manifest that we are very much behind in our orders at the present time with the post manufacturers to complete installations.

From H. J. Gille, The Minneapolis General Electric Company, Minneapolis, Minn.:

In Minneapolis during the last year, we have prosecuted a vigorous campaign in residence lighting and continued the campaign in the business district of the introduction of high efficiency lamps that was started some three years ago. We have added during the last year approximately 3000 new residence customers, and with the present inertia we hope to very largely increase residence business this year. In the prosecution of this work we have issued and distributed a large amount of advertising matter as well as availing ourselves of the newspapers.

At the beginning of 1910 we had about 300 ornamental street lights in service. We have added during the year 225, making the total in service at this time 525 posts.

During 1910 we have made an especial effort to develop tungsten sign lighting and feel that we have been particularly successful along this line, as we have today quite a number of large tungsten signs in Minneapolis. The tungsten sign lamp has given the electric sign business an impetus that has made electric sign lighting extremely popular with the merchants, primarily on account of the low cost for maintenance. All of our tungsten sign lamps are low voltage connected in series multiple. We use no sign transformers whatever. The result by using this system of connecting is highly satisfactory.

We have during the last year put large quantities of tungsten lamps in stores for store lighting. As near as we can roughly figure there are approximately 150,000 tungsten lamps in service in this city, being one-half lamp per capita. This lamp is gaining in popularity as time goes on and has amply borne out our original contention three and a half years ago, that the appearance of the tungsten lamp was the best thing that has happened to the business in many years.

During the year 1910 the 400 and 500 watt tungsten lamps were placed on the market and immediately became very popular. We have several of the largest stores in Minneapolis equipped with 400 and 500 watt lamps which have replaced arc lamps, with the result that the illumination is very satisfactory to the merchant, who would not change back to the old system under any circumstances.

Referring again to our campaign for residence lighting, we are using in conjunction with our campaign a booklet on "Residence Lighting." We have distributed a large number of these booklets and have found them very effective advertising matter.

During the recent Electric Show in this city we exhibited a miniature house completely equipped with electric light switching devices and all of the electrical devices on the market at this time to be used in the home. This house had created a great deal of interest, and it is needless to say that there were large crowds gathered about it at the show during the entire period of the show, as our men operated the switches and explained the various combinations. We have since the show closed put this house in the show window in our office, where it is daily attracting large crowds. The house is about 7 ft. high and 9 ft. long over all. The rooms are about 2 ft. deep.

From L. J. Auerbacher, Western Electric Company, New York, Flame Arc Department:

The flaming arc lamp is emerging from its chrysalis stage and developing into a most powerful factor for good and efficient lighting.

As we review the history of this type of artificial light, we find that when Bremer brought out the first practical lamp the total life on one trim was only three or four hours.

Gradually the electrodes were perfected, so that impregnated core carbons, 10 mm. diameter by 652 mm. long, were used, which gave a maximum life of 20 hours. As further research gave no hope

of getting longer life in this direction, magazine types of lamps were designed to take up to six pair of electrodes, and so arranged that each pair was successively fed. Naturally this complicated the lamp and of course the magazine lamps never found a large market.

Another step in the direction of long life was the making of electrodes having two and three cores and being really three electrodes welded together. Using two pairs of such electrodes arranged in two converging pairs, a life of 100 hours was obtained.

The cost of carbons under this method was still high, and the flame was unsteady, as the arc naturally had to travel over a considerable area.

The development of the regenerative flaming arc lamp was a long step in the direction of increasing life at a reduced cost. The efficiency of this type of flaming arc is high, and, as the arc is of high voltage, has the advantage of multiple connection on 110-volt circuits. The great drawback which has hindered the introduction of this lamp is its great unsteadiness. Owing to the circulation of the gases and long arc the flame wanders a great deal, often breaks, and sometimes for long intervals the candle power drops from the normal 3000 to about 100 to 200.

Recently a still further advance has been made, and one which will tend to increase the use of this efficient type of lamp for street lighting. Using but one pair of carbons of short length, a life of from 100 to 200 hours per trim is attained at an efficiency considerably higher than the magnetite lamp.

By partially excluding the air and by means of a cup or chamber below the arc, which acts as a condenser for the gases, long life is obtained from homogeneous impregnated carbons giving either a brilliant white or golden yellow ray. Lamps are arranged for two in series on 110-volt circuits, and on AC and DC currents, as well as on constant potential circuits.

Notwithstanding these rapid and important developments in this art, rumors of still greater life are heard from European laboratories, from which much is to be expected. The writer believes that lamps of 500 hours and even greater life on one trim will be developed, and thus give the central station man a most effective means of increasing his revenue and prestige.

The development of the inclosed long-burning carbon arc, while it gave the central station a unit which was cheaply maintained, also gave good street lighting a severe blow, from which it will not recover till the long burning flaming arc at a low cost per trim will be at hand to supersede it.

As these highly efficient and powerful units are offered to the central station, it remains to be seen if they can properly grasp the opportunity and not alone help light their customers in a better way, but also get an increased revenue from a light which no doubt the public will be pleased to buy at an increased price.

From F. R. Farmer, Secretary, Beardslee Chandelier Mfg. Company, Chicago:

Reviewing our business for the past twelve months, we cannot help noticing the difference in the grade of fixtures ordered compared with what was ordered in years previous.

Formerly, it was customary for the customer or consumer to make a selection of fixtures that would be required for installations, selecting them from catalogues, disregarding the style of architecture or lighting efficiency. The manufacturers' business was simply to fill the order, and to supply dealers with catalogues from time to time, illustrating designs that were good, bad or indifferent.

In the past year, the fixture business has just awakened to its real possibilities, and our orders now show that the trade demands art and utility combined.

We have attempted of course to keep pace with and to supply the demand, and during the past year we have been able to co-operate with the dealer, by supplying a greater variety and a better class of fixtures than previously.

This service of course has resulted in an increase of business, and we have made the necessary plans so that the coming year we will be able to co-operate more fully with the dealer in the way of furnishing specific information regarding our fixtures, and in elaborating and presenting

fixtures adapted to any particular building or plan of lighting.

We have increased our manufacturing facilities and believe that by making prompt shipments of fixtures which rate high as regards style, character, workmanship and quality of material we can look forward to a big increase of business the coming year.

FROM B. S. JOSSELYN, PRESIDENT, PORTLAND RAILWAY LIGHT AND POWER COMPANY, PORTLAND, ORE.:

The year just closed has witnessed the greatest advancement in the use of electricity for cooking, heating, lighting and power purposes in central station history.

The advancement in illuminating engineering and in the use and application of electric cooking and heating appliances is particularly noticeable.

The general adoption of high efficiency lamps has made it possible not only to greatly improve the standard of illumination, but to secure more and better satisfied customers on our lines.

Our illuminating engineering department is in close touch with all the architects and building and wiring contractors; thus we are able to improve the standard of illumination both in new and old buildings, business houses, stores and residences. So friendly are our relations that with one exception all of the architects submit the plans of new buildings and stores to us for complete lighting schemes and specifications. In this way we are able to encourage better illumination, to hold up the wattage where high efficiency lamps are used, and, best of all, to have satisfied customers on our books.

By means of a display room, in charge of a competent demonstrator, we have been able to sell large quantities of electric cooking and heating devices. That the addition of this class of business to our load is most desirable goes without saying.

Last year a campaign for better lighted streets was started. The merchants and property owners in the business districts were asked to subscribe for ornamental boulevard posts, lighted with Mazda lamps. This campaign was pushed with vigor, with the result that most of the business streets are uniformly lighted with these posts; over 500 of these posts are installed at this time. The majority of these posts have been sold to the property owners, slightly above cost, and five years' lighting and maintenance contracts made either with the property owner or with the tenants.

Too much stress cannot be laid on the necessity of an illuminating engineering department for the large central stations. The value of such a department in improving the standard of illumination, both of business already on the lines and business about to be added, cannot be overestimated.

FROM D. MCFARLAN MOORE, VICE-PRESIDENT AND CHIEF ENGINEER, MOORE LIGHT COMPANY, NEWARK, N. J.:

We wish to congratulate THE ILLUMINATING ENGINEER on its fifth anniversary. THE ILLUMINATING ENGINEER has certainly made an enviable reputation for itself during these five years as regards its great usefulness in the building of the so-called new profession of illuminating engineering. It has had a large share in the revolutionizing changes that have taken place during these five years in the great field of illumination.

The Moore Light headed the procession of new illuminants which were given to the world about this same time, and during the past twelve months has continued to make steady advance. In many of the European countries Moore Light companies have been established and are growing rapidly. The Moore Light long tube system when used for lighting large areas produces a greater number of useful lumens per pound of coal than any other system of lighting known, and when the current supply source is two-phase, as, for example, that from the new turbo generators installed in the New York Post-Office, the well-known image effect due to alternating current is entirely eliminated and the resultant flux of light is extremely pleasant and efficient and its diffusing qualities are incomparably better than can be produced by any other means. The Moore Light long tubes are the largest lighting units ever devised, but during the past year the Moore Light has

also been developed in the form of small units that are completely shipable and therefore enables the Moore Light Company to do a mail order business as distinguished from the construction work heretofore involved in erecting the long Moore Light tubes on the premises to be illuminated. These new shipable Moore Light units are particularly useful in satisfying in a complete manner the long felt want for a light that had color values that no excuses needed to be made for, and already many thousands of employees during the past few months have been able to work on full time solely because a number of the great industries, for example, the textile industries, are no longer completely at the mercy of the weather. Since the score or more most prominent industries dependent on color values have had the opportunity to only just begin to use the Moore Light for color matching the prospects for the new year as well as a steady demand for a future indefinitely long are extremely bright.

There is practically no merchant in the world who does not sell colored goods of some kind, and ultimately the public will demand universally that they be requested not to purchase goods without having an opportunity to judge their quality for themselves. It has only been, perforce, that the public has been so patient on this matter from time immemorial, but the great changes in this direction are in a line with the progress of the times.

From Lorin W. Young, Eastern Manager, Decorative and Illuminating Specialties, Macbeth-Evans Glass Company, New York:

Aside from the general line of business, which during the preceding year has been exceptionally good, many new pieces have been originated along certain lines of work. This is particularly noticeable in the amount of inquiries and goods ordered for semi-indirect lighting installations.

We have been able to make during the past year some Alba dishes, ranging in size from 12 to 21 in., showing a very heavy elaboration. These dishes are being used in place of real alabaster for semi-indirect lighting. There has been so great a demand for lighting units of a semi-indirect nature that it necessarily emphasizes the fact that this style of lighting is gaining in popularity.

Perhaps one reason for the demand upon us for dishes of this kind is due to the fact that real alabaster worked into dishes and bowls can at present only be obtained abroad, thus making it imperative in order to get a domestic production to procure a dish of Alba glass, which is the nearest thing to alabaster obtainable. As this style of lighting lends itself particularly to elaborate decorative effects, we feel certain that the present demand for this style of goods will continue.

We have also during the last year been called upon to make diffusive plates of Alba glass for use in connection with ceiling lights. This is another form of lighting where all sources of illumination are obscured.

While the trade still demands an immense quantity of reflectors to be used on fixtures in installations where direct reflection is desired, this growing demand for hidden sources of light seems to point the way to great activity in getting up new equipment for this style of lighting during the coming year.

From E. H. Peck, Manager, The Phoenix Glass Company, New York:

We find that the progress made within the past year, as related particularly to our work, has been, as might have been expected in a new science as is illuminating engineering, a healthy reversion from the first enthusiastic but often misdirected efforts back to the sound, solid doctrines such as underlie all sciences in general and place them on a sure basis.

When the renaissance in lighting came some few years back, the first step to take was to show some immediate accomplishment or something definitely better than the old practices; the obvious thing to do, and one at that time within the scope of the embryo illuminating engineer, was to improve the efficiency of lighting installations by decreasing the energy consumption. This was carried so far that often all else was disregarded.

Now since we have the tungsten lamp,

where extreme regard for quantity of light is no longer so necessary, more attention can be given to the quality of light and its decorative values.

We no longer believe efficiency rests with the relation of input to output as expressed in foot-candles on the floor or table level, but rather as output expressed by the proper amount of illumination in each part of the room, the relation of light and shadow and the color of the illumination by no means being small items as before.

Our trade has shown conclusively that the glaring, uncovered tungsten lamp is not to be tolerated, as the demand has been greatest for inclosing and semi-inclosing globes of translucent or roughed glass, modified as to design by beautiful etched or cut patterns.

"Pheno" reflectors have come to particularly fill the demands of good engineering, by the excellent manner in which they make the most of the light by the tungsten lamp, yet modify the brilliancy so that it becomes delightfully mellow.

We have seen these reflectors used in some of the largest and most up-to-date buildings—over seventy-five post-offices alone have now been equipped. We have found, during the past year especially, that a globe cannot be too beautiful to be appreciated; as a result we now have among our regular designs patterns that would have been considered impossible to make a few years ago, and surely unsalable. Colored glass, including amber, orange, pearl, opalescent and warm straw tinted globes are now in great demand, their possibilities for decoration being better understood. Globes for shower fixtures are becoming more and more popular and the outlook for the coming year seems especially good.

From H. M. Hirschberg, President, The Excello Arc Lamp Company, New York:

The past year in flaming arc lamp business has been our banner year. Our sales were larger and the widespread use of flaming arcs for illuminating purposes is becoming much more general every year.

We are now placing a long-hour lamp on the market, and we are quite sure that by eliminating the difficulty of frequent trimming the flaming arc will very soon become the most popular form of illumination in any large plant. We are looking for still bigger business this year than last.

From W. J. Grambs, Superintendent Light and Power Department, The Seattle Electric Company, Seattle:

Seattle is a city where over 90 per cent. of all the dwellings and stores are lighted by electricity. This is due to the rapid and modern growth of the city. We find that while we have made a large number of installations and materially increased our meters, our gross has not increased in proportion. This is due to the almost universal use of tungsten lamps and the changing of carbon filament lamps to tungsten. There has been a decided movement in the direction of large display signs, which we are encouraging in every way possible.

From H. G. McFaddin, of H. G. McFaddin & Co., New York:

Along with the broadening interest which has been felt throughout the entire field of illumination, during the past year, we have been considerably impressed with the good reception given to special lighting appliances. There seems to have been a marked appreciation, on the part of the consumer, of the value of securing the best possible illumination, rather as a matter of course than experiment. There was a time—and not so very long ago—when it was necessary to press the individual to take up any new development in lighting, whereas now he shows the result of general education and really appreciates the service which modern appliances can render him.

As an instance of this, we might well refer to the extent to which our business in "Emeralite" fixtures has developed. It was our purpose at the outset to introduce into this line not only a proper shade for the eyes, as we have endeavored to indicate in our slogan, "Kind to the eyes," but an artistic element as well. To that end we have designed and sold a wide variety of portables of such quality and

character as would look well on any desk or table. The demand for "Emeralite" shades and portables has been very large, quite beyond our most sanguine expectations. We find that they have been installed in many banking institutions and other offices, where the architecture of the interiors and furnishings was of a very high order. Many of the better class hotels and clubs have adopted them for their reading and writing rooms, some even providing them for all their rooms.

The extensive sale of "Emeralite" fixtures for illumination of limited spaces, such as desk or table tops, induced us to attempt the production of reflectors for general illumination which would give efficient distribution without glare and at the same time be artistic in appearance, harmonize with prevalent fixture design, as well as interior decoration, and be easily cleaned.

The many favorable comments in regard to our "Mefco" line again shows the keen appreciation of qualities which heretofore were not considered important by either the producer or user of illumination devices. We are glad to state that to our minds there seems every reason to expect a continued growth of appreciation for illumination, as a science and art, as people become more and more educated to their opportunities for utilizing light.

From T. G. Whaling, Assistant General Manager, Westinghouse Lamp Company, Bloomfield, N. J.:

Progress made during the past year in the art of manufacturing incandescent lamps in general is conceded to be the most marked advance in many years.

The most notable improvement has been the development of the continuous tungsten filament, which has placed the tungsten lamp on the same plane with the carbon type as regards uniformity of performance and stability.

The wire type tungsten lamp now stands for the best known to the art and no longer suffers in comparison with the other incandescent illuminants on account of its former fragility.

The superiority of the quality of its light and economy attained through its high efficiency are so thoroughly recognized that no comment is necessary.

The carbon type of lamp has received its share of attention through the development and research departments of the manufacturer with the result that it has been found possible through improved processes to re-rate the lamp to higher efficiency than those which have long been standard, giving the user at the same time the life values he has attained in the past.

From A. B. Skelding, General Manager, Tidewater Power Company, Wilmington, N. C.:

It is the writer's opinion that the ultimate development of street lighting will be in the use of tungsten lamps of comparatively small candle-power, in preference to any of the present types of arc lamps. The arch form of lighting for business sections on the basis of approximately 2-10 of a watt per square foot of street surface gives excellent results, while for a resident section about 1-10 of this amount of light is sufficient and more preferable in its results to the use of arc lamps on each corner.

From Norman Macbeth, Manager, Illuminating Engineering Laboratories of Welsbach Company, Gloucester, N. J.:

The outlook for the ensuing year is particularly bright; new lamps of various sizes and for different purposes are in process of manufacture and will be available at an early date.

Mention may be made of two new designs in small inverted lamps for residence use, two single mantle inverted lamps for commercial use and a four mantle inverted lamp, all of which embody devices which will reduce the gas company's maintenance labor by fully 50 per cent.

A filament ignition device, the action of which is simple and positive when used with a magnet valve, permits the use of gas lamps which may be lighted or extinguished by the pressure of a button installed at any convenient point. Low tension wiring, the potential not exceeding two volts, removes all the difficulties heretofore experienced with electric ignition.

For factories and large areas a new self-contained high pressure lamp, which may be connected to the present low pressure supply mains, promises a development of 3000 c. p. at the effective angle of 50 degrees from the vertical. There is also a development of reflectors which are more than deflectors for low pressure arcs, raising the utilization efficiency of these otherwise satisfactory sources.

The past year has seen a remarkable movement in outdoor illumination made possible by weather-proof lamps having from one to five inverted mantles. Gas "White Ways" and illuminated sign and bulletin boards are now prominent in many cities. The active co-operation of gas companies using the highest grade lamps and mantles along illuminating engineering lines has resulted in a better understanding and a more wholesome respect for gas illumination.

The awakening appreciation and interest manifested by gas men in illuminating engineering has been shown by the large proportionate gas interest attendance at the Johns Hopkins course of lectures—by the membership of the Illuminating Engineering Society, and the large number of papers presented before that society on gas subjects. The illumination of the exhibition buildings for the annual conventions of the National Commercial Gas Association the past two years has proven that gas lamps may be satisfactorily used for spectacular and decorative effects. Every gas convention, national or state, devotes a portion of its valuable time to papers or a discussion of gas illuminating engineering, all of which is being felt through the better educated and more highly trained sales and mechanical departments of gas companies.

We hear less of competition and more of the enormous possibilities for illumination by gas. Our electric friends are beginning to realize that a well designed gas installation presents a more difficult problem than the increasing of their sales through present consumers. Combination plants having electric competition find their best weapon in good gas or combination gas and electric installations, the brunt of the fight being readily taken care of with gas.

The amber light mantle, no longer "green," has proven its usefulness in residence work, and is gradually finding a place in commercial installations, where the high "white light efficiency" of the standard mantle is not required, and where tungsten lamps are used in combination. The lesser color difference removes one of the great objections to mixed lighting and breaks one of the main props of the "man with the hammer."

The new mantles, which show a laboratory life of 8000 to 10,000 hours, with approximately 10 per cent. depreciation, have made good in regular service during the past two years, and show not only a higher initial candle-power and ability to hold it, but a freedom from shrinkage and loss of color.

The work of the Illuminating Engineering Laboratories of the Welsbach Company has been steadily increasing; gas companies submitting an occasional problem have shown their appreciation by referring more of their difficult installations to this department for solution.

Looking back over the past five years and noting the marvelous change which has come over the gas lighting industry, and with a knowledge of the laboratory developments now under way, I can only say that the end is not only farther away, but that the result will be beyond even the most sanguine expectations of the greatest optimist in the business to-day.

From S. H. M. Agens, The Electric Motor and Equipment Company, Newark, N. J.:

I have your letter about the fifth anniversary of The Illuminating Engineer, and that you want a word from me on the progress made during the past twelve months, with an expression as to the outlook for the future.

Before attempting to comply with your request, I wish to take occasion, if you will permit me, to extend my hearty and sincerest congratulations to The Illuminating Engineer, and to you personally as editor, for the high standard which your publication has maintained, not only during the past year, but since its inception.

You have, to my mind, done wonders

with what may be termed a dry subject, eliminating as far as possible technicalities. The excellent illustrations that have been published in your magazine have had, I believe, a great deal to do with the interest you have awakened and sustained on the subject of illumination.

All this, I realize, has not come about without considerable effort and some self-sacrifice, and for that reason, in congratulating you, I wish you that measure of success which would rightfully belong "to those who have won the fight because they strove."

One of my chief lines of endeavor during the past year has been the development of a scientifically designed electric portable reading lamp. This work has not been done without results which I believe will be lasting. I cannot but help express the surprise that I have experienced in that people will continue to carelessly expose their eyes to unshielded brilliant light-sources. The sense of sight is by far the most important sense we have, and yet it is remarkable how people will thoughtlessly impair this important sense by using lighting units which are badly designed, when, with a little care in selection, proper devices may be had.

It seems to me, therefore, that the illuminating engineer should analyze the necessary problems, the manufacturers should carry out the engineer's views in his manufactured product, and that the editor and publisher should give publicity to such good devices as he may elect to recommend.

I believe that you have done, and are doing, and will continue to do, your part. I believe that THE ILLUMINATING ENGINEER has been of no little inspiration and help to those who have been working along these lines. I believe that the future has in store for us "more and better light," and that it is our privilege to "bask in its beams."

FROM J. P. CONROY, MANAGER, GENERAL GAS LIGHT COMPANY, NEW YORK:

As you are no doubt aware, previous to the introduction of the Humphrey Gas Arc Lamp, gas companies had only the single units to offer their trade, and at that time found it very difficult to hold the commercial lighting against the then new inclosed electric arc lamp. The gas arc was timely, and saved the commercial lighting for the gas companies. The growth and progress of this business since its introduction is so well known that it is scarcely necessary for us to enumerate its success here. Probably what appeared to be the most critical time in the business was the introduction of the tungsten filament electric lamp with the greater economy in current consumption as compared with the carbon filament. The tungsten lamp was hailed as the long hoped for key to a monopoly of the lighting business, so much so that one enthusiastic maker of tungsten lamps goes so far as to advertise, "Millions invested in gas properties are now at the mercy of the central stations," and many makers of single burner gas lamps who have not succeeded in making a success of the arc lamp attempted to drive the commercial gas lighting back to the small unit stage, as the proper means to meet the new electrical conditions, but it is our contention that the electric man is there because the state of his art has put him there, and he has ever since been engaged in trying to group his small units in compact form to make a higher power lamp, and to-day we find the advertisements in the electrical press announcing all tungsten clusters designed to supersede the gas arc lamp; thus we find our competitors coming again to the large unit lighting instead of forcing gas companies back into the small unit business to successfully meet electric competition.

In the last year's contact with the tungsten lamp, as shown, we see in cases of exceptionally low electric rates, the Humphrey upright mantle lamp has not been affected, and when severe competition is met the higher development in style and efficiency of the Humphrey inverted lamp has again given gas the dominating position, so much so that we find to-day nearly every gas burner manufacturer in the country endeavoring to perfect and market a gas arc lamp.

In the past twelve months we have practically stood alone as the only advocate of the large unit gas lamp, and our belief in

this means is the most practical for commercial lighting and we have met with great success. The demand for Humphrey gas arc lamps in the past five months has been far beyond our expectations, and many times during this period far beyond the capacity of our factory, disregarding the fact in the past twelve months we have practically increased our factory output, and at the present writing the popularity and demand for Humphrey Gas Arc Lamps is increasing far beyond our expectations.

From James P. Hanlan, Public Service Gas Company, Newark, N. J.:

Gas lighting is still open to the gas company on very favorable terms, providing the gas manager will make use of the lighting appliances that are now on the market. For instance: For residence lighting we can furnish proper illumination for any room or part of the house. We have burners of various sizes, plain or decorated glassware and by means of the pilot by-pass, lights may be turned on or off as easily as with the socket pull of the electric light. Then, too, artistic fixtures are on the market that give excellent service and compare favorably with any other fixture used for lighting purposes. We, also now, have mantles that will give any desired color of light.

This year our sales of lighting appliances and the accessories for residence use show a substantial increase which would seem to indicate that the public are willing to buy articles of merit. The same is true in a larger measure of store lighting and factory lighting, as is evidenced where this business is sought after along proper lines by a gas company. Here again, we have lights for every purpose, and we can give consumers good light without any sacrifice of decorative effect, as is used in ordinary store lighting.

Our sales of store lighting appliances showed an increase of 116 per cent. last year, many of these sales being displacements of old lighting equipments and many of them entire new gas installations.

Public Service sells gas and electricity, and it is the business of the gas company to sell gas, which we have done. We believe a dual lighting service to be the best for both the consumer and the company and with this in mind we have gone after our share of the store lighting business with gas.

During the fall and winter we made a number of very nice factory lighting installations, to the entire satisfaction of the factory owners and the men employed. Our men have been very successful in territories where we have attempted outdoor lighting with gas, as we now have several gas White Ways and only last week another was started in one of our districts. We have been rather conservative in going after outdoor lighting, intending first to remedy any little troubles that might develop before going in on a large scale. All told, however, we have installed about 450 outdoor gas arc inverted lamps this fall and winter.

The value of illuminating engineering as relating to the work of a gas company would seem to be so evident that it would seem unnecessary to advance arguments for its further adoption and application. Our company believes thoroughly in applying the principles of illuminating engineering in its lighting work and with that end in view, seven of its representatives attended the meeting of the Illuminating Engineering Society in Baltimore, and also the course of lectures. Not content with this, however, all of our representatives and heads of new business departments, including the agents of our offices, as well as those of our engineering staff who can attend, have been given the opportunity to attend a course in illuminating engineering at the company's expense, so far as time and incidental expenses are concerned. We have had three meetings since the first of the year, which have been attended on an average by 220 men. These meetings are held in the afternoon from three to five, and we expect to have at least nine more meetings this year.

The writer agrees with your policy that there is need of more and better lighting, but would emphasize the fact that we need better lighting and with better lighting additional lighting business is bound to come. In this work you may be sure of our co-operation.

From Frank W. Morse, Boston, Mass.:

No other known fact has impressed me with so much significance during the past year as related to the development in il-

lumination, as the increasing attention being given to the lighting appliances for incandescent units.

It indeed seems but yesterday that a lamp was a lamp and that was all there was to it—provided some means or other was presented to suspend it somewhere (anywhere!) between the floor and the ceiling. Perhaps it is true that in other industries the same development has been taken place as in lighting, but I am inclined to believe from both the increase and breadth of my business in lighting specialties that there has been no such forward movement equal to that along the lines or illuminating engineering.

For example, the fact that I have sold so many more lamp replacers for use where a high elevation is necessary, is proof that consumers are getting their money's worth from their lamps by watching out for depreciation.

The demand for adjusting fixtures for shop and factory use, automatic cord adjusters for regulating the height of pendant lamps all go to prove that the era of ignorance and carelessness is giving place to thoughtful consideration of the best possible use for every lamp in service.

In homes as well as in the commercial field, there has been a wonderful increase in demand for portable floor lamps to stand beside pianos, desks and easy chairs. Among artists, too, a knowledge of illuminating engineering seems to have spread as I have a special fixture for their requirements.

In addition to complete fixtures I have during the last year sold an increasing quantity of lamp guards ranging in their use from the smallest incandescent bulb to the largest arc and cluster. Looking over my list which to-day consists of about 150 varieties, I believe it constitutes the largest and most complete of its kind made.

From T. C. Martin, General Secretary, The National Electric Light Association, New York:

This society has enjoyed a wonderful degree of expansion and prosperity during the past twelve months. In July, 1909, the membership, comprising operating companies, manufacturing companies and the employees of both, numbered slightly over 3100. In the fall of that year, Mr. H. H. Scott, Chairman of the Membership Committee, began a most vigorous campaign to "organize the industry," with the result that toward the end of the year and with the beginning of 1910, a tremendous growth took place. By the time of the annual meeting in St. Louis in May, the membership had reached a total of 5250. Mr. Scott has continued his work during the current year so that on February 20 the membership had reached a total of not less than 6659, while there is every indication that it will be not less than 7000 by March 31, and 7500 by the time of the annual convention in New York at the end of May. Such growth as this is without precedent in engineering annals, but indicates the rapid development of the central station industry and the degree of influence and usefulness of the association.

It is indeed by its work that the association would be judged rather than by such extraordinary figures of membership gain. During the past year the association has affiliated with it geographic or state sections in Georgia, Mississippi, Nebraska and Vermont, and within the past month the national body in the Dominion, the Canadian Electrical Association, has also voted to affiliate, this being probably the first international instance of the kind. Similar movements toward co-operation are afoot in other states and it seems not at all unlikely that a sister society may be founded in Mexico. Another development of similar but more intimate character is the development of the company sections, of which there are now about thirty. The section in Chicago has a membership of over 700. Among the newer sections are those in Toronto and Schenectady, both vigorous and growing, while the local companies in New York have recently created a New York section, which already has a membership of over 500 and expects 1000 by June 1. At the present moment new sections are organizing in Scranton, Pa., and Pittsburgh, Pa., and are under discussion in at least a dozen other companies or cities.

It would be difficult to specify all the spheres of association activity, but the two most prominent of these are exemplified

in the new national sections, namely, the Commercial and the Power Transmission Sections. The Commercial has organized with a number of large and energetic sub-committees, which are taking up a great variety of central station work and this section is now enrolling a large number of members. The Power Transmission is proposing to hold two open sessions in New York on March 18, and in the meantime has addressed itself very effectively to the education of public opinion in regard to the true conservation of the water powers, namely, their full utilization under proper regulation. It has also through the Executive Committee of the body petitioned Congress to appoint a commission which shall investigate thoroughly the whole subject. The association has some twenty-five standing committees at work all the time with nearly two hundred of the best known men in the industry engaged, and many of the reports of the past year have been of a high order of merit. The Handbook Committee has issued a new edition of that invaluable medium of salesmanship. The Overhead Line Construction Committee is bringing out a final report which is confidently expected to be a standard for such work, and the Question Box Committee is bringing out a revision of the box for the last four or five years, which will be a veritable "Liebig's Extract" of central station practice, right up to date, typifying the best ideas and experience. The Public Policy Committee has cut out for itself an even wider sphere of influence and is almost in continuous session preparing to submit to the 920 companies in membership, full and carefully worked out suggestions for accident and sick insurance, savings plans, death benefits, profit sharing for employees and annuities for continuous and meritorious service. This is the most elaborate and significant work of the kind ever undertaken by a national industrial association.

The bulletin of the association which started as a merely eight or sixteen page monthly two or three years ago, has now become an invaluable means of intercourse amongst the members, and in the February issue reached a bulk of no fewer than 108 pages. Of these 94 were devoted to the Question Box, in which a great number of problems connected with the industry were brought to notice in the shape of questions, while scores and scores of answers come in large measure from the best known and most successful practitioners in the field.

The association has also during the past year published its Standard Classification of Accounts in two editions, for which there has been a growing and continuous demand.

Other work which the association has taken up has been the question of resuscitation from shock, and in the desire to bring the methods up to the latest point of medical knowledge it has convened a conference which includes all the leading electrical and engineering bodies and is participated in by other authorities, including the American Medical Association, the United States Army and Navy Departments, the United States Bureau of Standards and the American Museum of Safety.

The coming convention in New York City will be the Thirty-fourth and will mark the beginning of the second quarter century in the history of the association. It is planned by President Freeman to devote the work very largely to the consideration and discussion of committee reports, which will be both numerous and important. These, however, will be supplemented by a few papers of unusual excellence and by the addresses of men of national importance in politics and social economy. The growth of the association westward has been so rapid that it is now under favorable consideration by the Executive Committee to hold the next annual convention in 1912 somewhere on the Pacific coast, the furthest point having been Denver in 1905. The attendance last year at St. Louis was 2700, while 3500 will probably be the number in New York this year, and it is believed that in going out to the coast, these numbers are not likely to suffer any serious diminution; while the work and influence of the association will be vastly extended by such action, invitations from that part of the country being numerous and enthusiastic.

From A. D. Curtis, President, National X-Ray Reflector Company, Chicago:

Congratulations on your fifth anniversary! In arousing public interest in the subject of illumination, which has culminated in the present great movement for the Conservation of Vision, The Illuminating Engineer has certainly been a powerful factor of ever-increasing influence. From the policy and character of your publication I feel sure that you are not alone actuated by motives of commercial aggrandizement, but by a desire to benefit humanity as well. To this latter purpose there is no more fertile field of endeavor than the betterment of lighting conditions.

In working out the Eye-Comfort System of illumination, and making indirect illumination commercially available, we likewise have had the satisfaction of receiving daily expressions of appreciation that make us feel that we are accomplishing "something worth while," aside from mere commercialism. With the number of installations of this system made during the past twelve months, the people who are reaping the benefits of its comfort and charm are now numbered by the hundreds of thousands.

Like all others working in the line of progress, whether scientific, social, or political, our methods have not been without their detractors; but regardless of what some "experts" in the lighting field have said and done to discourage the use of indirect lighting, the *people* have set the seal of their unqualified approval upon the results obtained. And after all is said and done, it is the effect upon the eyes of those using any system of illumination that determines its actual value. From this court there is no appeal, even by the most scientific theorists.

As to the outlook for the future, the unanimous expressions of approval by those who have already used the "Eye-Comfort System," and the greatly increased demand for installations during the past year, justify us in predicting a still further acceptance of this method by the public during the coming year. Competent, disinterested judges declare that we have solved the problem of indirect illumination, and brought it to a practical conclusion, and that we will therefore necessarily be an important factor in the great Conservation of Vision Movement. We thus anticipate the pleasure of still furthering a worthy cause, and trust that we shall receive as much appreciation and material benefit as is right and good for us.

From W. F. Hessel, President, Charles L. Kiewert Company, New York:

The arc lamp situation has clarified considerably during the past year. The uncertainty regarding the future of the open flame arc lamp, which is limited by mechanical considerations to a life of about twenty hours, has disappeared and indications drawn from the experience of the past year seem to show that nothing can be expected in the way of developing a satisfactory and reliable long burning arc lamp by any of the expedients which have thus far been tried.

After a careful survey of the situation, we have decided to make no attempt to exploit the long burning type of lamp based upon any of the prevailing systems for accomplishing this result.

The new types brought out during the past year show an almost universal tendency toward the vertical arrangement of the carbons. This is not only in line with the best American practice but is highly desirable from a mechanical standpoint. The exploitation of the tungsten lamp has been of marked benefit in creating interest in better street lighting. However, as the advantage of the flame arc over the tungsten is over four times that enjoyed by the inclosed arc to the carbon filament incandescent, it appears that this interest should ultimately redound to the benefit of the flame arc lamp, and the latter is destined to occupy the place in street lighting formerly held by the inclosed arc lamp. The tungsten lamp will undoubtedly prove a factor of constantly increasing importance in its proper sphere, and we anticipate an early and radical improvement in the quality of lamps of this type.

The arc lamp carbon situation has not changed materially during the past year. The increase of the already high Amer-

ican tariff on imported carbons has caused importers to specialize particularly on those types of carbon in which quality is important. The importation of flame and projector carbons is rapidly increasing.

Carbon exports to Latin America are in a most satisfactory condition. South American users in particular are much more critical regarding the quality of inclosed arc carbons than are North American users, and in spite of the fact that the price of German carbons, f.o.b. Hamburg, is somewhat greater than that of domestic carbons, f.o.b. New York, the German carbons are usually preferred. Altogether the outlook for the coming year is most satisfactory.

From L. F. Blyler, New Business Manager Minneapolis Gas Light Company, Minneapolis, Minn:

An understanding of the principles of illuminating engineering is of inestimable value to the commercial gas man, as it enables him to intelligently comply with requirements of illumination in all its details and insures the installation of proper units for the various uses of gas light.

For commercial use, the reflex light and the reflexolier in the city of Minneapolis, so far as gas lighting is concerned, is accepted as the best and most efficient and satisfactory method employed by the majority of gas users. There is an increasing demand for the inverted gas arc where general illumination is desired. The high grade arc lamps are now mechanically perfect, and they are becoming a great factor in illumination.

The new small inverted gas burner with 2¼ globe holder will have the effect of almost completely changing the method of residence illumination. The fixtures now in use can be entirely equipped with these burners which are provided with neat adapters, and the entire fixture may be lighted, giving more pleasing and symmetrical effects without materially increasing the gas consumption. In combination fixtures made up in showers, etc., electric glassware can be used on these burners, without destroying the beauty of the lines of the fixture as was sometimes the case when it was necessary to use globes of different size and, in some cases, of different design.

Gas fixture manufacturers are producing a higher grade of fixtures of excellent design, and many old houses are being reequipped with modern straight gas fixtures. The combination fixture of the future will no doubt be equipped with complete outfits of these burners.

From A. D. Childs, Assistant to General Manager, Cooper Hewitt Electric Company, Hoboken, N. J.

The progress of the Cooper Hewitt lamp during the past year has been the most marked, at least in a commercial way, of any year since its introduction. The superficial prejudice against the light on account of its unfamiliar color has been rapidly giving way to a real appreciation of the peculiar advantages arising from this very fact. Public education is always cumulative in its effect, and the particular merits of the Cooper Hewitt lamp have been no exception to this rule. Every installation put in furnishes a practical object lesson of the performance of the lamp and its adaptability to a very large field of uses.

During the year we have greatly enlarged our facilities for production by the purchase and equipment of a new modern factory building, and although it was expected that this would meet all demands of expansion for some time to come, so rapid has been the increase in demand for Cooper Hewitt lamps that already our capacity in some departments is crowded.

We confidently look for the same measure of progress during the coming year as has been afforded us in the year passed. In the general advancement of the science of illumination there must necessarily follow a more careful adjustment of means to ends, and this fact alone will insure a larger use of the Cooper Hewitt lamp in the special fields for which it is pre-eminently fitted.

The Johns-Hopkins Lecture Course in Illuminating Engineering

The course of lectures delivered at the Johns-Hopkins University, Baltimore, Md., in co-operation with the Illuminating Engineering Society last October, are

now offered in book form, as noted in the advertising section of this issue. The publication committee are certainly entitled to more than ordinary praise for the remarkably quick time made in getting this extensive work published. The importance of the course, especially in view of the high position of the various lecturers in their several specialties, has already been commented on in our columns, and is noted elsewhere in this issue.

J-M Linolite System of Lighting

Under this title, the H. W. Johns-Manville Company has published a handsomely illustrated booklet of twenty-four pages and cover, fully describing the Linolite lamp, and the numerous accessories and combinations supplied for its use, and giving many valuable suggestions for the handling of special cases of illumination for which this form of lamp is pre-eminently fitted. This system of illumination is one which will help the illuminating engineer out of many a puzzling problem, and this booklet should be in his reference files.

The Commercial Section of the National Electric Light Association

This section is, so far as its practical working is concerned, a distinct organization, and whether or not suggested by the National Commercial Gas Association, is designed to fill the place in the electrical field that the latter association fills in the gas industry. This is decidedly a case where "Competition is the life of business." Mr. J. Robert Crouse has been put at the head of the membership committee, and the record which he made as the chairman of a similar committee for the Illuminating Engineering Society last year is a guarantee that the membership of this new section will be very greatly enlarged in the coming year.

The plan of the Commercial Section is too wide and comprehensive to be detailed here. In fact, no lengthy argument as to the advantage of a membership in the section to every employee of the commercial or selling department of a central station or manufacturer of electric lighting apparatus is needed. Two words are enough: JOIN IT. It stands for both co-operation and progress, and is that sufficient recommendation.

Announcements

CONGRESS OF TECHNOLOGY.

The Massachusetts Institute of Technology, Boston, will celebrate the semi-centennial of its founding on April 10, 11, by the convening of a Congress of Technology. A series of papers will be presented at this congress, covering a survey of engineering and industrial science, dealing with past history, present conditions and future prospects. These papers will be by specialists who have achieved reputation in the various lines, and who will speak from actual experience. As this institution was among the first to recognize illuminating engineering in its curriculum, it is to be hoped that the subject will find a place in the deliberations of this congress.

MINNESOTA ELECTRICAL ASSOCIATION.

The Minnesota Electrical Association will hold its fourth annual convention in the sun parlor of the roof garden of the new St. Paul Hotel, St. Paul, Minn., on March 14, 15 and 16. Of the twelve papers which are scheduled for presentation, five deal with subjects of interest to illuminating engineers, viz.:

Curb Lighting, by Ludwig Kemper, Manager, Albert Lea Light & Power Company;

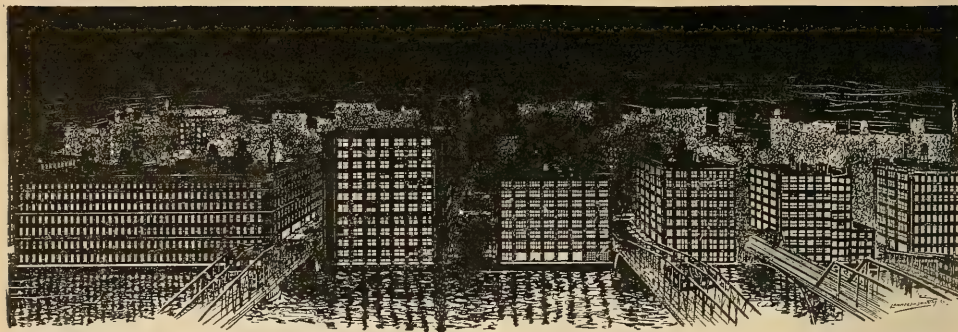
Window and Sign Lighting, by George Steinwedell, Commercial Agent, St. Paul Gas Light Company;

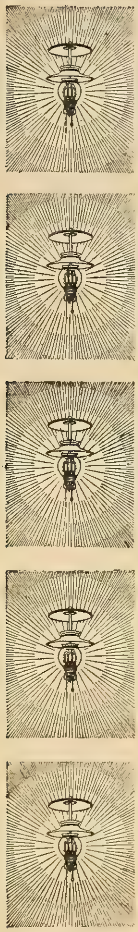
Residence Lighting, by C. E. Van Bergen, Manager, Duluth Edison Company;

Gasoline Competition, by a representative of the National Electric Lamp Association;

Incandescent Lamp Improvements, by Henry Schroeder, General Electric Company.

Mr. Harvey S. Tonks, who has for some years made a specialty of ornamental street lighting with the Elmer P. Morris Company, has branched out for himself with offices at 90 West street, New York City. Through his activity in this field Mr. Tonks has cultivated many friendly relations which should be of material help to him in his operations in the future.





Looking East From the Adams Street Bridge You Can See Two Thousand

Gas Arc Lights

Every one a 400 candle power unit. Every one working for big business people—people who are not likely to invest in illumination without knowing what sort of a lamp will give most light for the money.

As you will note, the view shows a section of the city along the river—ranging from J. V. Farwell Co. on the left to Edward E. Strauss & Co. on the right.

All of the two thousand gas arcs used in this district were installed by us. In every case we rent these arcs on a sliding scale, ranging from $4.50 to $5.40 per year, which sum covers delivery, installation and the work of maintaining and keeping them up to their maximum efficiency.

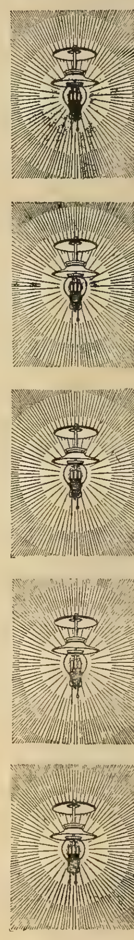
It is hardly necessary to say that the gas arc we handle is the very best in the world in every respect. We could not expect to meet competition with anything short of the most dependable and reliable lamp manufactured.

Up to date we have installed no less than 177,187 lamps of this one type.

If you have a store, a shop, wholesale depot or a factory, we solicit an opportunity to show you how your premises can be much better lighted for less money than you are now paying.

Drop us a postal to-day and we will be pleased to present to you figures and data covering the possibilities of Gas Arc Illumination for your own special requirements.

The Peoples Gas Light & Coke Company, Peoples Gas Building, Michigan Boulevard.



AN EXAMPLE OF EFFECTIVE PUBLICITY. THIS ILLUSTRATION, REDUCED FROM A FULL-PAGE ADVERTISEMENT IN THE CHICAGO DAILY PAPERS, SHOWS WHAT ONE GAS COMPANY IS DOING TO PROMOTE "MORE AND BETTER LIGHT" WITH GAS.

Proceedings of Technical Societies

Illuminating Engineering Society

The New York section held its regular monthly meeting on February 9 in the Dungeon of the Castle Cave, 271 Seventh avenue. After a beefsteak dinner the evening was spent in a discussion of lighting in architecture. The remarkable installation in the Soldiers' Memorial in Pittsburgh served as a basis for the discussion, which was participated in by Mr. Hornbostle of Palmer and Hornbostle, architects, Mr. Bassett Jones, Jr., the illuminating engineer, and by a number of other speakers, including Dr. A. H. Elliott, the chairman. The meeting was especially well attended and the utmost interest and good feeling was in evidence.

The monthly meeting of the Chicago section took place on February 16. No set papers were presented, the evening being taken up with a discussion of illuminating engineering problems in the smaller cities. Mr. J. R. Cravath spoke somewhat at length on the subject, stating that the lighting problem in the smaller city is essentially one for the central station to meet. Mr. C. A. Luther, of the Peoples Gas Light & Coke Company, spoke of a need of educational work in the smaller cities and added a word of caution against overburdening the customer with light. Mr. J. G. Learned, of the North Shore Electric Company, still further emphasized the need of educational work in the smaller towns.

American Institute of Electrical Engineers.

At the meeting of the Toledo section, held on February 3, Mr. Harry Cared gave an address on the subject of illumination. Mr. Cared is the engineer for a concern having flaming arc lamps and his subject dealt mainly with this form of illuminant. He made the rather astonishing statement that the arc is not injurious to the eyes, claiming that he had been looking into arc lights for the past ten years without any evil effects.

On Monday evening, February 20, the Cleveland section of the American Institute of Electrical Engineers held its regular monthly meeting. After supper at the Rathskeller, the members met in the Engineering Building of the National Electric Lamp Association, as guests of the latter, and listened to three papers on subjects pertaining to electric illumination, the first by Mr. H. T. Spalding on "Mazda Street Lighting," the second by Dr. P. W. Cobb on "The Physiology of Glare," and the third by Dr. Herbert E. Ives on "The Production of Artificial Daylight."

Mr. Spalding presented numerous stereopticon views of various types of street lighting fixtures and installations.

Dr. Cobb discussed the effect of scattered light in the eye in diminishing sensibility. Referring indirectly to the tests of Mr. Arthur J. Sweet, which indicate that glare in artificial lighting is caused by light coming from sources located within a fairly definite angle of approximately 25 degrees with the direct line of vision, Dr. Cobb said that while 25 degrees or thereabouts may be the practical limit of glare effect, he was aware of no physiological basis for such a limit.

Dr. Ives discussed and demonstrated the "additive" and "subtractive" methods of producing light of the color known as "average daylight." He produced light of this color, using the additive method, by adding light from a tungsten filament lamp to that from a mercury vapor lamp,

in the proportions of one to two, approximately. Using the subtractive method, he cut off from the light of a tungsten filament lamp by means of a selective screen, just enough light of the longer wave lengths so that the transmitted light had the color of average daylight.

After the meeting a light lunch was served in the employees' restaurant.

The American Medical Association.

"Some Effects of Bright Light on the Eyes," by Mr. Herbert Parsons.

This is a discussion of the subject which illuminating engineers commonly speak of as glare and which has been receiving so much attention of late. This paper is one of the most valuable recent contributions to the subject.

The Electric Club, Chicago.

At the weekly luncheon of this club, held on February 15, Mr. F. J. Pearson, chairman of the Chicago Section of The Illuminating Engineering Society read a short paper on "The Illuminating Engineering Society: Its Origin, Scope and Future." Messrs. George C. Keech and J. R. Cravath, former chairmen of the section, added some interesting remarks.

Convention of Byllesby Companies.

At the recent convention of these companies in Chicago, Mr. A. Larney, manager of the New Business Department of the Oklahoma Gas & Electric Company, read a paper on "Effective Illumination." Mr. Larney dealt particularly with the electric sign, citing the chariot race sign in New York as an instance of the magnitude which this form of advertising has now reached. Although this sign employs 6400 lamps, the electric current used amounted to less than $88 a month. This shows to what extent economy and efficiency is studied in this most spectacular of all forms of lighting and is a convincing proof of the error of certain loose statements made at the recent meeting of the New York section of the Illuminating Engineering Society in which the electric sign was specially mentioned as a case where effect was produced regardless of efficiency.

Public Lectures on Illumination

The advantage of educating the public in the proper use of light is being more generally recognized by the lighting industries. There is nothing more fascinating, even to the layman wholly unfamiliar with the technology of the subject, than experiments successfully performed before his eyes. This furnishes a means of securing and holding attention which is immensely valuable in the work of public education.

The Stearns Lighting & Power Company, Ludington, Mich., recently presented two lectures to the public, the opera house being used for the occasion. The program was divided between two speakers, Mr. Ralph Beman of the National Electric Lamp Association, who spoke on residence and store lighting and the application of the new high efficiency lamps to this class of illumination, and Mr. Harry F. Swindell of the Holophane Company, who discussed the subject of reflectors. The first speaker illustrated his remarks with lantern slides and the second with actual demonstrations of various types of reflectors.

The Public Service Electric Company of Trenton, N. J., tendered a lecture to the public, February 15, on the subject "Illumination." The lecturer was Mr. F. Laurent Godinez. Mr. Godinez's unusually successful lecture courses last winter were commented upon in these columns at the time. He has since severed his connection with the commercial interests who were then promoting the work, so that there can now be no possible motive for leaning to any particular device or system, although Mr. Godinez is too thorough a scientist to allow such bias to interfere with his public utterances.

The lecture was divided into three parts, each being accompanied with striking and effective demonstrations of the subject matter of his discourses.

The attendance at all of these lectures was up to the capacity of the auditoriums in which they were held, and great public interest was shown by the after-results.

Review of the Technical Press

American Items

New Publications

Human Engineering. Winthrop Talbot, M.D., editor; monthly; $1 a year; 15 cents a copy. Publication office, Cleveland, Ohio.

The first issue of this new periodical bears the date of January, 1911. It is standard magazine size, 36 pages and cover.

The purpose of the publication is thus stated in the first paragraph of the leading editorial:

> *Human Engineering* is published to provide a means of exchanging experiences on the human side of industry and to open a forum for discussion of the conservation of human energy. It is a magazine, NOT OF PHILANTHROPY, but of INDUSTRIAL MANAGEMENT AND INTELLIGENT BUSINESS THRIFT IN ITS MODERN AND BROADEST SENSE. On the mechanical side of engineering we have the information needed to keep our mechanical work up to date, presented in a readable and concise form by scores of ably edited journals. On the human side there are none.

Human Engineering will try to present each month:

> 1. Original articles contributed by employers and employed, whose experience will be worth heeding.
> 2. A digest of articles of note taken from journals published along other lines.
> 3. A bibliography of current literature and notes of interest, dealing with the mechanics of human effort.
> 4. A public forum or moot court for the open discussion of points which permit of honest difference of opinion.
>
> It is hoped that employers and employed will contribute to its columns freely.

Dr. Talbot is at present in charge of the General Welfare Department of the National Electric Lamp Association, and is thoroughly familiar with this phase of modern civilization, which is so rapidly growing in importance. The field is certainly a wide one and offers a correspondingly large opportunity for the creation of a magazine of real power and importance. This first number is a modest beginning, but decidedly creditable and promising. It is to be hoped that the subject of illumination will receive the treatment to which its importance entitles it in "human engineering." The legibility of the text is somewhat interfered with by the single column arrangement, the long lines being distinctly more difficult to follow than the shorter lines of the standard double column pages.

"DATA."

Due to an oversight this most unique of all publications that has yet come to our hands was not reviewed on receipt of the first number, which bears the date of September, 1910.

The purpose of this publication, as stated by the publishers, is to "publish a periodical devoted exclusively to engineering data that shall be practical and brief and shall present for the busy technical man only the essential data, aiming to prepare this matter in condensed form and upon a 3 x 5 page convenient for ready filing and quick service." The leaves are attached at one end in the manner of the ordinary writing pad, so that they can be readily detached for filing, and on one side of each leaflet is given data on some subject which is capable of expression by tables or mathematical curves, the subject being printed in plain type at the top. The back of the sheets is used for adver-

tising. Mr. Edward Wray is the managing editor and is assisted by a dozen specialists in various branches of engineering. The subscription price is $1.00 per year. Publication office, 92 La Salle street, Chicago.

ILLUMINATION IN INDUSTRIAL BUILDINGS; *Data*, September, 1910.

ILLUMINATION SUMMARY OF TESTS; *Data*, September, 1910.

COST OF OPERATING ARC LAMPS; *Data*, October, 1910.

ARC LAMP ILLUMINATION; *Data*, December, 1910.

CANDLE-POWER CURVES OF ARC LAMPS; *Data*, December, 1910.

FOOT-CANDLE CURVES OF ARC LAMPS; *Data*, December, 1910.

COMPARATIVE VALUES OF ARC LAMPS; *Data*, December, 1910.

GRAPHIC COMPARISON OF ARC LAMP ILLUMINATION; *Data*, December, 1910.

REQUIRED INTENSITY OF ILLUMINATION; *Data*, January, 1911.

TUNGSTEN CLUSTERS MOUNTED ON TROLLEY POLES, by W. B. Foshay; *Electrical World*, January 26.

An illustrated article describing the proposed method of using tungsten lamps on trolley poles which is being tried out in Walla Walla, Wash.

SPECIAL STREET LIGHTING AT GENEVA, NEB.; *Electrical World*, February 2.

A short illustrated article describing a recent installation of tungsten lamps on brackets attached to buildings.

SPECTACULAR CENTRAL STATION LIGHTING IN PORTLAND, ME.; *Electrical World*, February 2.

Description of the sign and outline of the lighting used by the Portland Electric Company.

SYSTEM OF INDIRECT ILLUMINATION; *Electrical World*, February 2.

Refers briefly to a number of prominent installations of indirect lighting showing characteristic fixtures.

STREET STANDARDS AT MISHAWAKA, IND.; *Electrical World*, February 2.

A brief article showing night and day views of the installation.

MEASUREMENT OF LAMP RESISTANCE, by Frederick Bedell; *Electrical World*, February 9.

The writer describes a method of measurement which is a modification of a method previously published in the same journal in June, 1905.

INTERNAL ELECTROMAGNETIC FORCES IN LAMP FILAMENTS, by Carl Hering; *Electrical World*, February 9.

An interesting discussion of the subject by this well known investigator.

RELATIVE EFFICIENCY OF LIGHT PRODUCTION BY CONSTANT TEMPERATURE AND VARIABLE TEMPERATURE INCANDESCENT LAMP FILAMENTS, by Evan J. Edwards; *Electrical World*, February 16.

The thesis of the writer is thus stated in the opening paragraph:

> The question of relative efficiencies of incandescent lamps operated on direct current and on alternating current has been much discussed, but never very carefully analyzed. The writer has not found that the question of the existence of a difference in efficiency is a settled one. Therefore, of course, no quantitative values have been presented. It is the purpose of this discussion, mainly, to present a method by which the efficiency ratio may be quantitatively obtained for any candle-power function on the basis of equal light production and to show that the efficiency of a given average of light production is probably always higher when obtained from a varying filament temperature.

A comprehensive discussion, giving formulæ and curves, then follows.

MEASUREMENT OF INTRINSIC BRIGHTNESS BY A NEW METHOD, by Herbert E. Ives and M. Luckiesh; *Electrical World*, February 16.

The instrument used was a modification of the Holborn-Kurlbaun optical pyrometer. A Nernst glower was used as a background against which the other illuminants were measured. The results of measurements of different commercial light-sources agree fairly closely in the case of incandescent electric lamps, but

differ very greatly in the case of the carbon arc. A full table of results is given.

Effect of Frequency on the Variations of Candle-Power of Incandescent Lamps; *Electrical World*, February 16.

A digest of a thesis presented on this subject by Messrs. E. B. Kiely and H. B. Wasserboehr, Jr., at the Massachusetts Institute of Technology in June, 1910. Data is given in the form of curves.

Illumination of a Modern Factory, by Harry C. Spillman; *Electrical World*, February 23.

An illustrated article describing in detail the illumination of an automobile factory in Detroit, using tungsten lamps with metal reflectors.

Street Lamp Ratings, by Charles L. Tremaine; *Electrical World*, February 23.

A letter to the editor pointing out the difficulties and inconsistencies in the measurement of illumination of lamps in actual performance.

Electricity in a Huge Mail Order Establishment; *Electrical Review and Western Electrician*, January 28.

An extended illustrated article describing the electrical plant of Sears, Roebuck & Co. The lighting system is thus briefly described:

> The lighting installation in the various buildings is one of the most complete and approved installations in an establishment of this character. The total equipment of lamps comprises eighty inclosed arc lamps, 3,000 tungsten filament lamps, 6,200 Nernst lamps, 32,000 carbon filament lamps and 200 Cooper Hewitt lamps.
>
> In the majority of large rooms where many are employed, single-glower Nernst lamps are almost exclusively employed. These are generally suspended about 5 ft. from the ceiling by ornamental chains and are arranged in single rows spaced about 10 ft. apart. In other departments where conditions warrant it, carbon or tungsten filament lamps are used. In the printing building and shipping department Cooper Hewitt lamps are employed. The eighty arc lamps are used only for exterior lighting and in the train shed.
>
> In one department, Mr. Church, chief electrician of the plant, has made an installation of indirect lighting for experimental purposes. Sixty-watt tungsten filament lamps are employed, installed in ornamental bowl reflectors. This installation has proved so satisfactory that extensions of this system of lighting are being contemplated.

Exception taken to Statement Regarding Lack of Foresight in Design of Incandescent Lamps, by Roscoe Scott; *Electrical Review and Western Electrician*, January 28.

A letter to the editor, in which there is a detailed reply to certain statements of Dr. Louis Bell in the previous issue, criticizing the lack of standardization in tungsten lamp bulbs.

Festival Illumination at the Chilian Centennial; *Electrical Review and Westeern Electrician*, February 11.

A brief illustrated article showing some of the principal decorative lighting effects of this exhibition.

British Practice in the Conversion of Street Gas Fittings, by Francis H. Davis; *Electrical Review and Western Electrician*, February 18.

An illustrated article showing a variety of methods of adapting tungsten lamps to ordinary gas street lanterns.

Street Lighting, by Winn Meredith; *Journal of Electric Power and Gas*, February 4.

A short illustrated article describing in detail the tungsten lampposts used in Alameda, Cal.

Steady Versus Unsteady Voltage for Incandescent Lighting on Alternating Current Systems; *Central Station*, February.

An article illustrated with curves and dealing with the question of voltage regulation and its effect upon candle-power.

A New Era in Electrical Illumination, by Rollin W. Hutchinson, Jr.; *The Engineering Magazine*, February.

In this article, which is the third of a series, the writer discusses glower and vapor lamps.

The writer states that the "Moore light is the nearest approach yet made to the much desired cold light, as exemplified in Nature by the firefly." This is an error

—probably inadvertently—on the part of the writer. What he evidently has in mind is that the Moore carbon dioxide light is the nearest approach to daylight. In point of efficiency, however, it is excelled by several of the modern electric light-sources. The article concluded with "some points to be observed in artificial illumination," at the close of which the writer pays his respects to the self-styled illuminating engineers who are wholly incompetent.

THE PASSING OF THE DINGY SHOP, by C. A. Howell; *The Isolated Plant,* February.

A short illustrated article showing the use of special lighting in a number of industrial applications.

NOTES ON ILLUMINATING ENGINEERING IN GREAT BRITAIN, by a London correspondent; *American Gas Light Journal,* February 13.

An excellent review of the various papers and discussions on illuminating engineering subjects that have appeared during the past year in England.

THE GAS SHOW AT FORT WAYNE; *Progressive Age,* February 1.

An illustrated article giving a short account of this very succesful undertaking.

LIGHTING OF THE WORCESTER AUDITORIUM, by E. A. Howe; *Progressive Age,* February 15.

A short illustrated article describing the illumination of this auditorium, which is said to be the largest public building in New England equipped entirely with gas.

THE RELATIVE HYGIENIC VALUES OF GAS AND ELECTRIC LIGHTING, by Norman Macbeth; *National Commercial Gas Association Bulletin,* February, 1911.

THE WAVE THEORY OF LIGHT, by Prof. Charles Sheard; *Optical Journal and Review,* February 16.

This is the second instalment of a series, and treats the subject in a brief and popular manner.

CHICAGO STREET LIGHTING; *Municipal Journal and Engineer,* February 8.

A short article discussing the recent report of the Department of Electricity, that city.

PAVING AND LIGHTING A SMALL CITY, by P. E. Green; *Municipal Journal and Engineer,* February 8.

Editorials

Electrical World:

IMPROVEMENTS IN FLAMING ARCS, February 2.

INTERNAL ELECTRO MAGNETIC FORCES IN LAMP FILAMENTS, February 2.

LIGHTING IN ARCHITECTURE, February 2.

MEASUREMENTS OF INTRINSIC BRIGHTNESS BY A NEW METHOD, February 2.

CHANGE IN THE VALUE OF INTERNATIONAL VOLTS, February 9.

INTERNAL ELECTROMAGNETIC FORCES IN LAMP FILAMENTS, February 9.

LIGHTING AND ARCHITECTURE, February 16.

MEASUREMENTS OF INTRINSIC BRIGHTNESS BY A NEW METHOD, February 16.

THE GROWTH OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION; *Electrical Review and Western Electrician,* February 18.

FLAMING ARCS; *Electrical Review and Western Electrician,* February 18.

SAVING LAMPS AT THE COST OF LIGHT; *The Central Station,* February.

CHICAGO STREET LIGHTING; *Electrocraft,* February.

FACTORY LIGHTING; *Engineering Record,* January 28.

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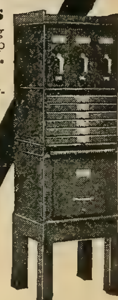

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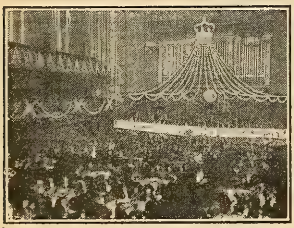

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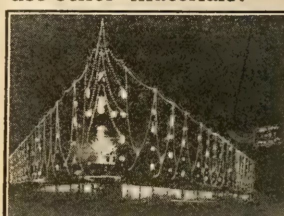

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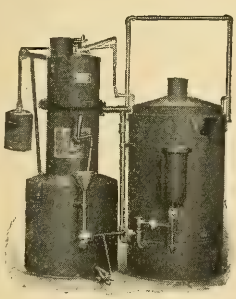
These are the people, too, who will listen to a proposition intelligently presented, give it the consideration which it deserves and act upon it intelligently.

It is among such people that any straightforward man, with reasonable activity and industry, can earn a satisfactory and pleasant living by installing Pilot Generators for Acetylene lighting.

Once you get the consumer to realize the fact that, by means of Pilot Generators, he can enjoy *actually better* illumination than the general run of residents of the big cities secure, with scarcely any more trouble or care than with an ordinary cellar furnace. And you will soon find yourself building up a business which will spread of its own accord on the recommendation of its users.

Here is perhaps *your* opportunity—that opportunity which, they say, comes but once to a man in his lifetime.

It will pay you to look into this if you are looking for a promising future amid the most approachable and most friendly people on the face of the earth.



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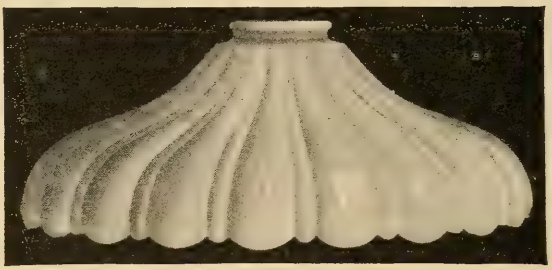

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LUCEO REFLECTORS

are unique in material, appearance and effect—highly artistic whether in daylight or when illuminated.

As can be seen by the illustration they are graceful in form, adaptable to most styles of fixture design. On that account, they are in harmony with architectural schemes for new buildings and are essentially appropriate for the renovation of old installations which have become old-fashioned and outworn their usefulness.

LUCEO REFLECTORS are diffusers of illumination. They do not alone project the light below, but permit sufficient diffusion about the walls and ceilings. They are of limpid, onyx-like translucency, permitting a soft, even distribution.

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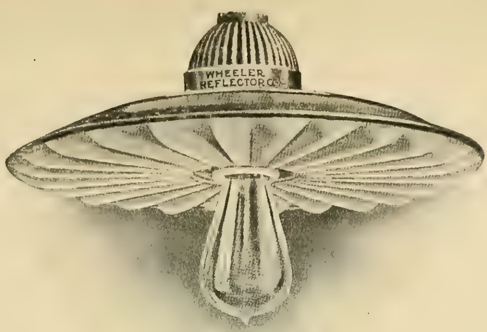
WHEELER
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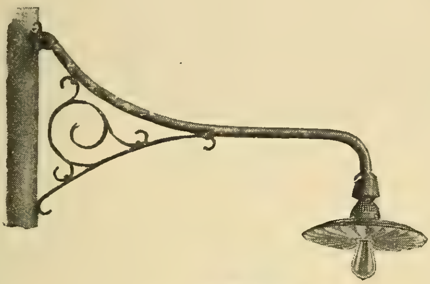

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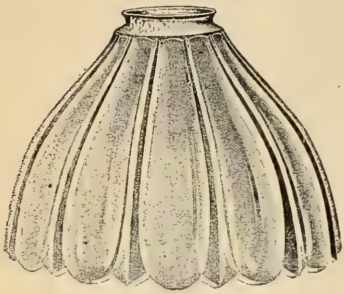

No. 225 "60 Watt"

in recommending "Ray Do" reflectors to your best friends.

Take your haberdasher, for instance. More than likely he is losing business by not having for his furnishings the very best possible lighting that can be secured. Tell him about "Ray Do" reflectors and you are showing him the way to more business.

Ray Do. reflectors will greatly improve the illumination, and add to the appearance of stores, offices, restaurants, etc.

Write us for details, prices, etc.

KRAKNO GLASS CO. - Pittsburg, Pa.

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Most of the Merits of any Lighting Device may be demonstrated by Photometric Tests vouched for by a recognized independent authority.

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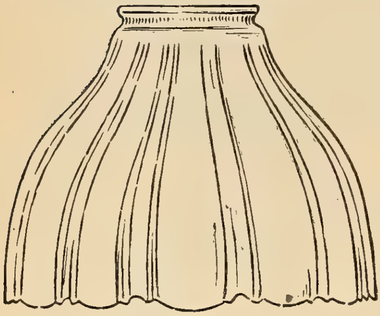
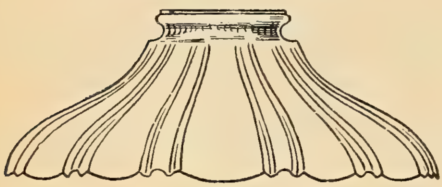
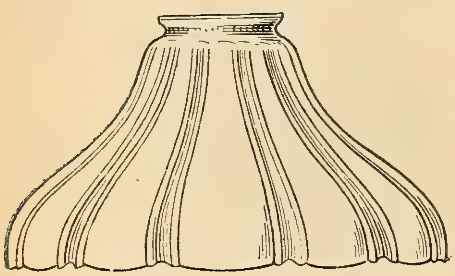


FLARED TYPE



SEMI-FLARED TYPE



With the general increase of intensity secured by modern light-sources, it was but a natural sequence that means be secured for properly subduing, diffusing and redirecting the light — at the same time conserving the artistic considerations in compliance with the canons of good architecture.

CAMIA REFLECTORS

"tame" and subdue the ferocious glare of the new high efficiency lamps, control the rampant and eye-irritating rays so that the engineer and architect can co-operate in attaining ideal results for the consumer.

CAMIA REFLECTORS

offer the clean, cool appearance of marble, softened by a satin effect. They are made in BOWL, FLARED and SEMI-FLARED types, with graceful lines, to fill the requirements of specific distribution and modern fixture design.

WRITE FOR OUR CAMIA FOLDER
describing the full line; with also photometric data

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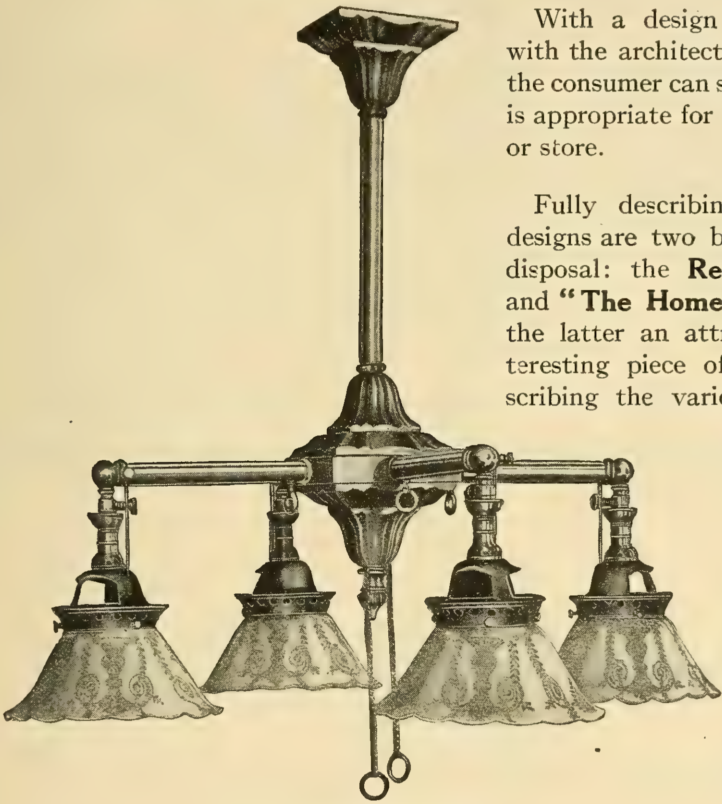
Residence and Commercial Lighting

In view of the comparatively poor design and quality of fixtures which have been available in times past for gas illumination the artistic **Reflexoliers** obtainable today come as a surprise.



No. V 1285—Sheffield-Colonial

With a design to harmonize with the architectural decoration the consumer can secure just what is appropriate for his home, office or store.

Fully describing our various designs are two booklets at your disposal: the **Reflexolier** Book and **"The Home Illuminated,"** the latter an attractive and interesting piece of literature describing the various advantages of these fixtures for the home.

Send for them and you will appreciate how much gas illumination can be improved.

Call on our Illuminating Engineering Laboratories for assistance on any problem in gas illumination that may confront you.

THIS SHIELD OF QUALITY STANDS FOR GENUINE Welsbach OUR TRADE MARK ON EVERY BOX

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CAT. 6141—500-Watt Lamp

RANGE OF REFLECTORS	Distributing Diffusing Concentrating	Short Base Skirted Base Large Base	RANGE OF LAMPS

BENJAMIN REFLECTOR SOCKETS are carrying the industrial field before them. They combine every necessary recent adjunct of effective electric lighting, from properly related lamps and reflectors to Tungsten shock absorbers. Engineers are recommending them; dealers are selling them; owners of mills, shops, and factories are installing them.

LET US TELL YOU OF OUR LARGE INSTALLATIONS

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The MEFCO

"Kind to the Eyes"

Represents a radical departure in the field of modern illumination.

The MEFCO has been made to *look well* either with fixture finish or interior decorations, and besides, possesses the following points of merit :

Remarkable efficiency without glare.

Has no crevices or frosted surface to collect dust.

Blown—not pressed.

Its delicate color must be seen to be really appreciated —a pleasant green by daylight and a soft primrose by artificial light.

Whether you are a fixture manufacturer, dealer, architect or engineer, we will be glad to send you a sample with such special information as will be of service to you.

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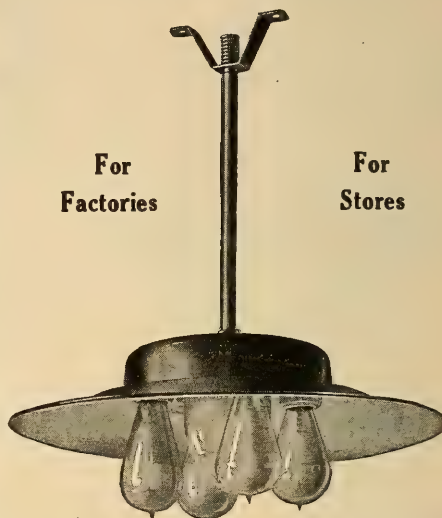
FOR MANUFACTURERS AND STOREKEEPERS

THE CAMPBELL MAZDA ARC



is a serviceable and inexpensive lighting unit, without any frills or unnecessary features.

In any community any central station solicitor, contractor, or engineer can turn over a good profit by installing these fixtures, for they are "just the thing" for supplying the requirements of a vast majority of stores, offices, industrial plants, etc.

The consumer gets the service and there is a good profit, too, for the man who secures the installation. Jobbing agents wanted.

Write for details, costs, etc., for we have a proposition worth your looking into.

THE CAMPBELL MANUFACTURING CO.

Manufacturers of High Grade Pressed Brass and Steel Goods, Lamp Fixtures of all descriptions, Automobile Parts, Dies and Tools. Metal Spinning

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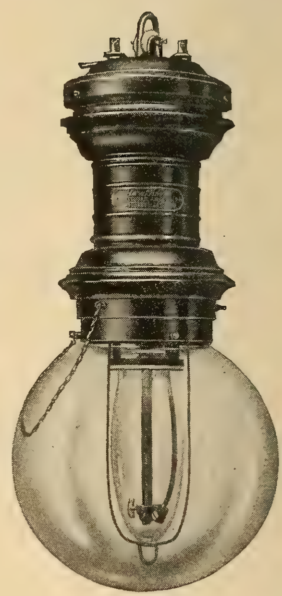
For Out-door Illumination

Western-Electric
HAWTHORN
Flaming and Enclosed Carbon Arcs

Every requirement of out-door lighting is met satisfactorily and efficiently by these two lamps.

The Hawthorn Flaming arc is the most efficient illuminant for lighting signs, store fronts, construction work, piers, yards and large interiors. It gives 3,000 candle-power and consumes but 550 watts.



The Hawthorn enclosed carbon series arc lamp for street lighting gives a steady light of daylight quality. For reliable, effective service it is unexcelled.

The Western Electric Company Furnishes Equipment for Every Electrical Need

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The
Illuminating Engineer

Vol. VI APRIL, 1911 No. 2

"AMERICANITIS"

In simple bodily strength the American of to-day is the unquestioned superior of any highly civilized race of ancient or medieval times. With the boundless freedom of an undeveloped country, an enormously increased knowledge of the laws of hygiene, and an abundance of the choicest of foods, such a result is inevitable.

But in spite of this natural physical strength and longevity, there is an astonishing number of premature breakdowns. "Overworked—laid off for a complete rest," is the statement constantly being made in regard to all classes of workers; while sudden deaths from "heart failure" are an every-day occurrence. This prevalence of the untimely failure of a physical machine that is naturally capable of great endurance is commonly dismissed with the trite remark that "we Americans are living at too high tension."

We are beginning to look for the causes of conditions of vast import in apparently the most trivial and unsuspected phenomena. Yellow fever and the mosquito, bubonic plague and the common rat, typhoid and polluted water are impressive examples. The place that eye-strain occupies as a cause of "Americanitis" is but just beginning to be realized. One of the foremost American psychologists even goes so far as to claim that there is no other source of brain fatigue, basing his conclusion on numerous experiments in which the most exacting mental work has been performed ten hours in succession with only a half hour's intermission without any perceptible weariness.

When the fact is considered that the perfect eye is a rare exception among Americans; that in nearly all cases of mental work, and in many kinds of physical work, the eye has to constantly maintain a sharp focus; and that the conditions of illumination, particularly artificial, under which the eye works, are unnatural and often excessively irritating, the part which eye-strain plays in the general prevalence of nervous breakdown may well be viewed with alarm.

There is no question of public hygiene to-day that so urgently demands thorough investigation and correction as the hygiene of the eyes. When we have arrived at the real facts in the case, and have generally introduced a rational system of using and conserving the organs of vision, we shall find that "Americanitis" in its various forms and stages has practically disappeared from our midst.

As the most immediate and practicable means to this end, let us have "More and Better Light."

E. L. Elliott.

American Association for the Conservation of Vision

The Organization of a National Movement for the Prevention of Blindness, and Safeguarding the Eyes of the People

Courtesy of The Literary Digest, N. Y.

DR. F. PARK LEWIS, PRESIDENT.

The organization of the American Association for the Conservation of Vision, the preliminary steps of which were noted in our issue of January, took place on March 25. In response to a call sent out by the temporary secretary, Mr. S. E. Eliot, a meeting was held in the trustees' room of the Sage Foundation, 105 East Twenty-second street, New York City, for the purpose of adopting a constitution and by-laws, and electing permanent officers. The interest and enthusiasm that was so conspicuously displayed at the December conference was equally in evidence at this meeting, the attendance being unexpectedly large, especially in view of the fact that it was called for purely business purposes, representatives from several different states being present.

The meeting was called to order by Dr. F. Park Lewis, of Buffalo, and Mr. S. E. Eliot, elected temporary secretary. After briefly reviewing the events which had led up to the demand for a National Association, and the general scope of the work, Dr. Lewis called upon Mr. Edward M. Van Cleve, of Cleveland, to report for the Committee on Organization authorized at the December conference. Mr. Van Cleve thereupon read a draft of a constitution and by-laws, and moved its adoption as read; the motion prevailed practically without discussion. In accordance with the provisions of the constitution, the chairman then appointed a Committee on Nominations, which immediately went into conference.

During the deliberations of the nominating committee, the Chair called on representatives of various interests for remarks.

Mr. Van Cleve reported the remarkably satisfactory results that have been obtained in Cleveland in controlling ophthalmia neonatorum ("babies' sore eyes"), an infectious disease which is responsible for 10 per cent. of all the total blindness in existence. In thirty-one cases treated within fourteen months, twenty-four resulted in completely saving the sight.

Mr. Neve, of North Carolina, reported briefly the progress of the work in sight-saving in that State.

Mr. Bolling gave a summary of the work carried on by the United States Steel Corporation for the prevention of accidents in their various works. As a result of this work the number of accidents has been reduced 50 per cent.; accidents to the eye constitute about 1 per cent. of the total number.

Mr. Law, vice-president of the Fidelity and Casualty Co., spoke quite fully on the general subject of prevention of accidents, dwelling particularly upon the need of public education in this field.

Dr. DeSchweinitz, following the suggestion of the Chair, spoke on the subject of uniform statistics in regard to hospital records of cases of diagnosis and treatment of the eyes. He summed the matter up briefly in the statement that there was no uniformity, and a general lack of any

records at all, both of which conditions are very regrettable and should be reformed.

Mr. Louis Bell expressed the opinion that the most important problems now confronting illuminating engineers were those pertaining to the physiology and psychology of vision, and that the ophthalmologists must bear the brunt of the work, but their efforts would be most heartily seconded by the engineers. There should be a much closer affiliation of the two professions in both their work and interests.

Mr. E. P. Hyde spoke briefly of the work of investigations being carried on under his direction at the Laboratories of the National Electric Lamp Association, and stated that there were still many unsolved problems in regard to the effect of various qualities of light upon the eye, and that much investigation was needed before conclusive results could be announced. He added a word of caution against too much publicity in regard to matters that were still unsettled.

Officers of the Association.

Mr. Burritt then presented the report of the Nominating Committee, as follows: President, Dr. F. Park Lewis, Buffalo; vice-president, E. Leavenworth Elliott, New York; Board of Managers, Samuel Ely Eliot, New York; James P. Munroe, Boston, T. Comerford Martin, New York; H. F. J. Porter, New York; J. A. Shawan, Cleveland; F. S. Tomlin, New York; E. M. Van Cleve, Cleveland; Dr. Hiram Woods, Baltimore; Prof. M. C. Whitaker, New York. No other nominations being made, the secretary was instructed to cast the vote for the officers nominated.

The constitution provides for the election of the secretary by the Board of Managers, and at a session of the board, held after the adjournment of the general meeting, Mrs. Ida B. Hiltz was unanimously elected.

The association has secured permanent quarters in the United Engineering Societies Building, 25 West Thirty-ninth street, New York.

Plan of Organization.

The plan of organization, as set forth in the constitution, possesses some unique features. It is a combination of the general principles followed by both the scientific societies and the sociological and philanthropic organizations. The general conduct and management of the work of the association is vested in a Board of Managers which is self-perpetuating, of which the president is the chairman, and the secretary the regular executive officer. In this respect it resembles the university, or institute. The President, vice-president, and treasurer are elected by the association at large, after the manner of the usual social and popular national organizations. Ten honorary vice-presidents will be elected by the board.

The general field of work, which is very large, is divided into six departments, each having a Director and staff of associates, with such sub-committees as may be most advantageous for prosecuting the work. The departments are as follows:

Department of Disease and Defects of the Eye.

Industrial Department.

Educational Department.

Department of Statistics and Information.

Department of Legislation.

Department of Publicity.

Directors and associates will be appointed by the president with the approval of the board.

Membership is of two classes, charter members and members; the former includes those who joined before the first annual convention and pay an initiation fee of $5; a member being any one who signifies his interest by applying for membership and paying an initiation fee of $1. The annual dues are $1. The nominal membership fee and the universal interest in some one or more phases of the work should insure a very large membership.

Affiliated Associations.

The organization of this national association is the outgrowth of work already done by various organizations and committees as follows: Committee on Ophthalmia Neonatorum of the American Medical Association, Russell Sage Foundation Committee on the Prevention of Blindness, Committee on Prevention of

Blindness of the New York Association for the Blind, Committee on Prevention of Blindness of the Massachusetts Commission for the Blind, Missouri Association for the Prevention of Blindness, Kentucky Association for the Prevention of Blindness, Sight Saving Society of Missouri, Arkansas Society for the Prevention of Blindness, Committee on Prevention of Blindness of the Pennsylvania Association for the Blind, California Association for the Prevention of Blindness, Committee on Prevention of Blindness of the Wisconsin Association of the Blind, Ohio Commission for the Blind, Committee on Conservation of Vision of the National Educational Association.

Scope of the Work.

While the association originated in concerted efforts directed toward prevention of blindness, it will be seen by the different departments provided that the conservation of vision in the broadest sense of the term will be considered in its future work. The whole question of light and illumination in the industries, in schools, and through them in the homes, will have its due share of consideration. The best professional skill and talent in the country will be enlisted in the work of investigation, and principles and practices standardized as fast as conclusive results are obtained. The collection and correlation of the results of all work thus far done will form the basis for subsequent investigations. Active co-operation with the various associations and committees named will be secured by their direct affiliation with one or more of the departments of the association.

One of the most important functions of the association will be the education of the public in regard to the various phases of the conservation of vision, from the prevention of infantile blindness to the proper use of the eyes of all ages. We used to hear much of the proverb that "the love of money is the root of all evil"; it is not: ignorance is the root, stem, and branch of evil. The antidote for ignorance is publicity; and the rapid multiplication of associations and committees of all descriptions, whose central purpose is to uncover the sources of the various ills to which modern civilization is heir, is but the natural evolution of general knowledge in place of the general ignorance which has prevailed until very recent times.

Generally speaking, the will of the people to correct abuses, whether social, political, or commercial, far outruns their knowledge of conditions and causes. In New York City, and doubtless in other large cities, there are hundreds of little "banks" placed in drug stores and other public places, with a card inviting contributions to provide for blind babies; and doubtless thousands of people, touched by the awfulness of the calamity, drop in a coin without for a moment suspecting that an insignificant expenditure of money, backed by the strong arm of the law in the way of enforced education, would in a short time practically wipe out the whole fraternity of blind babyhood. How many people know or realize that decidedly the larger part of all blindness is positively preventable, and therefore needless?

Again, it is not even suspected by the general public that there are hundreds of naturally capable citizens wearing the insignia of disgrace, and spending their time in the hopeless servitude of the convict, for no other basic crime than defective vision; and that the life of many an individual has been practically ruined from the same conditions developed in youth. There is evidence beyond all dispute that eye-strain is a frequent cause of all degrees of moral obliquity. As Mr. Bell remarked at the meeting, "man in this twentieth century has become a nocturnal animal." He might also have added that, in the larger cities, he has also become a burrowing animal, living in caves and subterranean passages into which the direct rays of the sun never enter. The eye is thus subjected to conditions of artificial light that introduce an entirely new problem in the physical economy. So rapid has been the progress in physical science that we have for the time lagged behind in physiological and moral adaptation to conditions.

The need of both research and publicity on all questions pertaining to the use of the eyes is therefore most urgent. The intense interest exhibited in the movement for the conservation of vision wherever it has become known is an evidence of the general need for action. It is doubtful if there is a single field of humanitarian endeavor so promising of rich results as the conservation of vision.

Lectures on Illumination

How the Public Is Being Educated Through Both Precept and Example

Unquestionably the most fascinating and spectacular of all the natural sciences, particularly in its elementary principles, is the science of light and optics. As the sense of vision affords by far the larger and more impressive portion of the sensory impressions which result in human action, it must follow that the physical cause of these sensations should afford the most varied and abundant opportunities for startling experiments and interesting scientific explanations. Furthermore, the subject lends itself admirably to the purpose of public exposition. This is particularly true now that the electric light is available in every city and most of the smaller towns.

Both advertisers and pedagogues have a formula to the effect that the first necessity in their work is to secure attention, and second, to create interest. This identity of principle would be expected when it is realized that advertising is only a kind of education. It is generally admitted among both professional engineers and the everyday user of light that there is a lamentable lack of popular knowledge on the subject, and hence the question of public education in regard to the matter affords one of the ever present and pressing needs.

Following the psychological principles just laid down, the public lecture, utilizing the opportunities for spectacular experiments and demonstrations afforded by modern methods and apparatus, offers one of the most efficient means of stimulating public attention and of arousing such a degree of interest in the subject as will result in further study. The regulation scientific lecture, which consists simply in the delivery of a discourse couched largely in a language unintelligible to the layman, is about as dry as a town in Maine; but the subject of light and illumination can be made so self-luminous by an exhibition of its own inherent wonders that the spectator cannot help but look and listen.

A public lecture of this description was given by Mr. F. Laurent Godinez in Camden, N. J., under the auspices of the local board of trade, on the evening of Thursday, March 2. It is no discredit, but rather praise, to speak of this lecture as a public entertainment; for the scientific lecturer who fails to entertain his audience, particularly if it is an audience of laymen, has failed in one of the most vital parts of his work, and must charge the fault entirely to himself, for there is no department of science that is not inherently and essentially interesting. Mr. Godinez brought out the several scientific points that he intended to make with perfect clearness, and with a masterly command of experimental demonstration. In devising apparatus and methods of illustrating the various principles of illuminating engineering he has certainly shown consummate skill, as well as a high degree of inventive ingenuity.

The lecture was divided into three parts with short intermissions between to afford time for changing the apparatus used in the demonstrations, and at the same time give the audience a short recess. On the principle that change is rest the entertainment was shifted from the ocular to the auricular during the intermissions, an orchestra having been provided for the purpose. In the first part the elementary principles of light and optics were explained, large diagrams of the eye and the camera being used to assist the audience in understanding the explanations. The difference between light and illumination was brought out in a striking manner (no pun intended) by showing a clock face with a tungsten lamp directly in front of it as an example of lighting, and covering the lamp with an opaque screen so that the source became invisible as an example of illumination. The fact that the color of objects is due to the color of the light they reflect was also very forcefully shown by a simple experiment.

The second and third parts of the lecture were devoted to practical demonstra-

F. LAURENT GODINEZ.

tions of good and bad illumination. The most striking experiment of the lecture was the demonstration of good and bad show-window lighting. For this purpose two full-sized windows were exhibited on the stage, with different methods of lighting so arranged that they could be thrown on and off instantly.

Fig. 1 is from a photograph of the stage showing the two windows with the most common defect in lighting, the one on the right being lighted with a fixture suspended from the ceiling equipped with bare lamps, and the left having lamps studded along the inner edge of the window.

Fig. 2 shows the same windows effectively lighted by the use of the proper units placed in the top of the window out of the line of vision. It is hard to believe that the two illustrations are not photographer's tricks, but such is not the case; the actual difference as it appears to the eyes of the audience is fully as great as represented. The lighting shown in Fig. 1 is first exhibited, and when this is instantly changed to the illumination shown in Fig. 2 the usual expressions of astonishment on the part of the audience are pronounced and spontaneous.

The exhibition of the various types of lamps and reflectors formed an exceedingly interesting part of the lecture. A number of stereopticon views were shown, but only to illustrate applications of the principles explained that would be impossible to reproduce on the stage. A picture of a thing is unquestionably better than nothing at all, but the thing itself is decidedly best where it can be obtained.

The value of the public lecture as a means of creating public sentiment and attention has been recognized, and practiced to a limited extent, for a long time by various manufacturers as a means of commercial publicity. As such lectures are of course free there can be no criticism on this method of advertising, assuming that the lecturer adheres strictly to facts and does not lead the audience to erroneous suppositions or conclusions. Mr. Godinez' lecture, however, is not to be classed as having a primarily commercial object, having absolutely no connection with or interest in any particular form of light or lighting device. He speaks with the same freedom from prejudice or restraint as would a professor in college to his class.

The commercial advantage of such a lecture, however, must necessarily be of no small value indirectly to central stations. There is a vague but general notion on the part of the public that every lighting company is intent upon "beating" their patrons "as much as the traffic will stand." Of course, it takes no farsighted reasoning to show how absolutely fallacious such a supposition is. Any merchant who would deliberately set out to see how much he could extract from his customers and how little he could give them in service or goods for their money, would be committing commercial suicide. The lighting companies are not philanthropic organizations, but they have business acu-

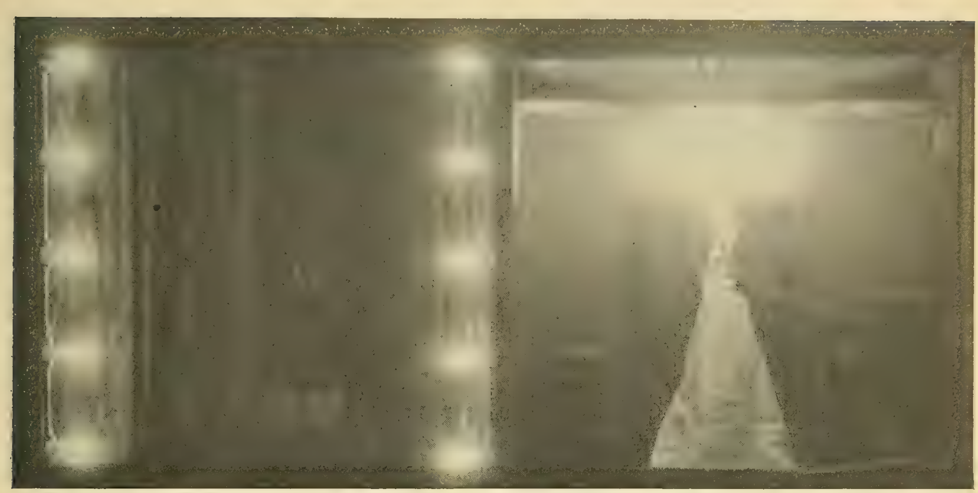

FIG. I.—COMMON DEFECTS IN WINDOW LIGHTING.

men enough to know the value of the satisfied customer. Ignorance on the part of the public in regard to the use of light, and the elementary principles of the business of making and distributing luminants, is the one serious obstacle in the way of complete success. It would be money well spent for any lighting company to endow a professorship in a local college or university for instruction in these matters were it not for the fact that the existing prejudices against commercialism would largely nullify the work by creating suspicion and prejudice. A single lecture from an impartial source, and especially of the attractive nature of that of Mr. Godinez, cannot help but be a valuable and effective means of public education. That such is the case has been amply shown by the number of inquiries received by the lighting company on the day following the lecture.

A great deal has been said within the past few years as to the value of publicity as a remedy for existing or possible evils, politically and commercially. Of the efficacy of the remedy there cannot be the slightest doubt. To come into the open

FIG. 2.—EFFECTIVE SHOW WINDOW LIGHTING.

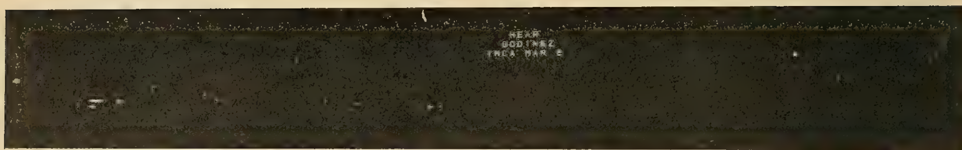

FIG. 3.—ELECTRIC SIGN, ANNOUNCING LECTURE.

with a *bona fide* offer of assistance, backed up by a convincing demonstration of possibilities as set forth in a lecture of this kind, is an application of a principle which is now generally recognized as sound and legitimate.

Essential Features of Flame Arc Lamp Design

By R. F. Pierce

The flame arc lamp is of such recent development in America that those designers who have attempted to avoid the apparent complexities of the foreign types have been compelled to experiment in unfamiliar fields and without the accurate data available for more perfectly standardized apparatus. The not unexpected result has been that the product has in many instances, failed to achieve the success to which it should be entitled so far as mechanical simplicity is concerned.

The several conspicuous failures to develop a satisfactory flaming arc lamp in America have done more to retard the use of this valuable lighting unit in this country than all of its inherent shortcomings combined. The foreign lamps, at least those produced by the more prominent manufacturers, have given excellent satisfaction in service and leave nothing to be desired in the way of reliability or economical upkeep. There are, however, commercial difficulties in the way of filling the American demand for apparatus of this sort with an imported product which have prevented the flaming arc lamp from occupying the position to which it is entitled by its remarkably high efficiency, and although a considerable number of lamps of this type are now in use, it is really an insignificant factor, as compared to those types which have been developed in America.

It is of course perfectly natural that the flaming arc lamp should have been brought to the highest point of perfection in Europe, as it has been manufactured there for nearly ten years and the essentials of its design have been fully determined and thoroughly understood. So many of the American designs show evidences of an insufficient understanding of the really essential features that the writer believes that a setting forth of these essentials will not only assist in the improvement of the domestic product, but enable the purchaser to avoid a large amount of more or less disastrous experimentation.

Two Distinct Characteristics of the Flame Arc.

The flame arc has two characteristics which make it necessary for the designer forthwith to forget all that he ever knew about the design of arc lamps employing pure carbon electrodes. In the first place, the arc is extremely unstable and if operated either above or below the voltages for which the electrodes are designed, more or less troublesome slagging is apt to take the place of proper burning. The electrodes must therefore be fed by small increments, much smaller than are permissible in the ordinary inclosed arc lamps. In the second place, the products of combustion, being solid, introduce complications which are entirely absent from pure carbon arc lamps. It would appear that these considerations are so obvious that

they could not be ignored by any conscientious designer, yet the shortcomings of domestic flame arc lamps are due almost entirely to under-estimating the importance of these features.

As regards feeding mechanism, a so-called "clock-work" mechanism is obviously the most suitable. It has essentially a sneak feed action, may be made extremely simple and durable, and may be easily and positively controlled. Furthermore, and it is quite alone in this respect, it permits the entire mechanism having to do with carbon control to be housed in a compartment by itself, so far from the arc chamber that there is practically no danger whatever of the solid deposit from the arc reaching it. Flame arc lamps of this type have been run for several years without the slightest fouling or corrosion of feeding-mechanism parts by arc fumes. The chamber, immediately above the arc, is, however, subjected to the action of large quantities of these fumes and the locating of any mechanism having to do with the feeding or controlling of the arc, such as clutches, worms, gears, slipper blocks, etc., introduces a hazard in reliable operation, that is very apt to be dangerous.

By far the greater proportion of troubles in clock-feed lamps are traceable to the slipper block of the direct current inclined carbon type. This slipper block, being immediately above the arc, is subjected to a high degree of heat, as well as the clogging action of the arc deposit. It is this fact that has largely influenced most flame arc manufacturers to abandon this type. The blow magnet, which is necessary for the control of the inclined carbon flaming arc is also a frequent source of trouble. It requires accurate proportioning and location with reference to the arc and further complicates the adjustment of the latter for current and voltage.

Inherent Difficulties in the So-called "Gravity Feed."

One type of feed, which has occupied the attention of designers since the introduction of the flame arc is a so-called "gravity feed." As a matter of fact, it is no more a gravity feed than any other, as all types of automatic feeding apparatus are operated by gravity only. A better term would be "underfeed" or "self-feed," as in this type the lower tip of one of the electrodes rests upon a stop of metal or refractory material and the electrodes are fed by the burning away of a portion of the tip resting on the stop. This type of feed has two obvious disadvantages. In the first place, if the arc is allowed to come in contact with the stop, a portion of the latter at least will be fused, and successive occurrences of this sort will burn the stop away until it fails to support the carbons, thus producing a short circuit. On the other hand, if the portion of the electrodes in contact with the stop is not completely consumed, feeding will not take place and the lamp may refuse to feed entirely. In practice, lamps of this type are usually adjusted so that the stop will be slowly consumed and replaced every six or eight trims.

A modification of this type suggested by the writer three or four years ago and independently conceived and placed upon the market by a German manufacturer, consists of two pairs of carbons, one pair being positive and one pair negative, in a downwardly converging position with regards to each other and the two carbons of each pair also converging with reference to each other and jamming together at the lower tip, all four carbons being supported by a common carrier at the top. The carbons are thus fed by their own combustion and no stop is required. This design eliminates the most serious objection against those lamps in which a stop is used to support the carbons, but is open to the common objection which holds against all inclined carbon arc lamps, namely, the use of slipper blocks, blow magnets and long, slender carbons with metallic vein. A recent development of this type uses carbons of substantially rectangular cross section containing two or three cores each. These carbons are not so frail as the ordinary flame carbons and have no metal vein. This is a desirable feature, as the high breakage of the ordinary type of flame arc carbon is a serious factor when expensive electrodes are concerned. The present trend is distinctly away from the inclined carbon type of flame arc lamp and practically all models which have been brought out during the

last year are of the vertical carbon type. Certainly from a mechanical standpoint the vertical carbon type is far superior. It eliminates the weakest part of the mechanism and does away with the extremely fragile carbon, besides producing a far better distribution of light. The vertical carbon flame arc lamp may be so designed that the only moving part in the portion of the casing above the arc chamber is the carbon holder.

This certainly affords the simplest type of construction that could be conceived, as, in considering the mechanism of the flame arc lamp, that which is isolated in a separate chamber on the top of the lamp and properly protected may be disregarded as not being susceptible either to deterioration or any trouble likely to impair the reliability of the lamp.

The Problem of the Long-Burning Flame Arc Lamp.

The universal clamor for a long burning flame arc lamp has naturally produced a great deal of activity in this direction. For certain purposes long burning hours may be an actual drawback, as for instance in foundries, etc., where the outside of the globe would naturally be heavily coated with dirt and soot after a few hours. In such places the enforced attention of the trimmer, say every other day, is highly desirable. In general the short burning life of the open flame arc carbon is much less of a disadvantage than it is generally considered to be. In America, however, the tendency has been to subordinate every other advantage, efficiency and reliability included, to burning life. Very often this works decidedly against real economy, but the American engineer makes such a fetich of decreased labor cost that he is usually willing to spend $1 in cash to save 25 cents worth of labor, and quite naturally the arc lamp manufacturer is more concerned in giving a purchaser what he thinks he wants than in producing really economical and reliable apparatus.

The efforts to produce a long burning flame arc lamp have been along two different lines, disregarding the magazine types which are hopeless monstrosities, so far as the American market is concerned.

The open flame arc offers but one avenue of improvement, so far as the present types of electrodes are concerned, and this is in the direction of providing a greater volume of carbon for consumption. As the limit of practicable length has already been reached and increasing the number of carbons beyond that required by the simplest form is clearly impracticable, a natural development was along the line of thin flat carbons, containing two or more mineralized cores side by side. As a comparatively small proportion of the light from the flaming arc is produced by the incandescent tips of the electrodes, the efficiency of this type of lamp does not suffer greatly by comparison with the ordinary type. It has the disadvantage, however, of requiring a blow magnet to control the arc, and as the latter is constantly shifting in position through a magnetic field of varying intensity, the form and characteristics of the arc are far from uniform. This type of carbon is especially well adapted to the type of lamp mentioned above, in which the carbons are jammed against each other at the apex of their " V " shaped path, and in fact an open flaming arc lamp of this design burning 100 hours on one trim of four carbons has already been placed on the market. It has, however, the common disadvantages of all lamps using carbons of the Bremer type of being unable to produce white light, except at an enormous loss in efficiency, and distributing most of the light within 30 degrees from the vertical. It is thus unsuited for street lighting, in which practically a daylight color of light is being demanded.

The majority of recent attempts to produce a long burning flame arc resort to the inclosure of the arc. While this decreases the efficiency about 50 per cent. it steadies the arc and permits the use of cruder feeding mechanism. The great difficulty is the disposal of the ash deposit from the arc. A settling chamber must be provided in which the burnt gases may be completely and continuously cooled, to such a point as to insure the complete deposition of solid oxides and the cooling of the remaining gases so that they may be re-introduced to the arc chamber without cracking the globe, or unduly heating the

electrodes. This is easily accomplished while the condensing chambers are comparatively clean, but after a few months' burning the deposits impair the cooling capacity of the condensing chamber walls to such an extent that the solid oxides are no longer completely deposited, but are carried back into the globe and depositing thereon reduce the candle-power by as high as 60 per cent. Under these conditions the efficiency of the inclosed flame arc may fall as low as 20 per cent. of that of the open flame arc. Furthermore, the gases, being no longer properly cooled, raise the temperature of the electrodes to such a degree that the burning life may be decreased by 50 to 60 per cent. As the deposits bake on quite solidly they cannot be removed by ordinary cleaning. The only feasible manner of obviating this difficulty would seem to be the provision of a cheap, removable condensing chamber, which could be removed at a nominal cost and replaced in a few minutes. Furthermore, it is extremely difficult to maintain tight fitting contacts for the exclusion of the air, as the solid deposits, unless carefully removed from all fitted parts, will prevent their feeding properly.

The above mentioned difficulties in the way of producing a flaming arc lamp, which shall combine all desirable features, such as long burning life, simple and reliable mechanism, and above all, efficiency, would indicate that the flaming arc lamp lacks a great deal of being developed to a permanent form, and the evolution of a commercially important lamp of this type must depend upon developments of which no present indication exists.

Three Interesting Problems in Industrial Lighting

By W. C. Hubbard.

A Draughting Room.

The threshold to the great majority of industries is the draughting room. Here it is that the abstract idea is first made concrete. What the chart is to the navigator, the mechanical drawing is to the manufacturer. Mechanical drawing is admittedly one of the most trying of occupations, so far as the eyes are concerned; and the problem of furnishing an illumination that will reduce eye-strain to the minimum has accordingly rightfully received much attention. The conditions are, however, comparatively simple. It affords one of the cases in which an absolutely shadowless illumination is preferable. Since there is no vision requiring relief or perspective, and the instruments are held in such various positions as to make it impossible to prevent confusing shadows from directional light.

One of the most practical methods—and decidedly the most economical—of producing such an illumination is by the use of Cooper Hewitt lamps. The great extent of luminous surface produces, even where a single lamp is used, a shadow having so short an umbra, and so gradually shaded penumbra as to give very little annoyance; and when several of the lamps are used a practically shadowless illumination is produced.

Added to this essential quality there is also a very distinct advantage in the greater visual acuity which is a marked and now well known characteristic of this source of light. This enables the finest lines, even those made with the hardest drawing pencils, to be seen with remarkable clearness. In the making of tracings the reflections due to the high gloss of the tracing cloth are eliminated, while the greenish-blue color of the light brings out blue-prints with startling vividness and distinctness.

The only possible objection that can be urged against the Cooper Hewitt lamp for draughting-room use is the very dark color which it gives to ordinary reds. Where it is found necessary to use red ink, this difficulty is easily overcome by choosing an ink made of an aniline which fluoresces a brilliant red under the Cooper Hewitt lamp. Ink of this description is regularly for sale.

Instances are on record where draught-

FIG. I.—A WELL-LIGHTED DRAUGHTING ROOM.

ing rooms that were not especially well provided with daylight illumination have been equipped with the Cooper Hewitt lamp, and the windows continuously curtained off so as to provide a light of uniform quality as well as intensity during the entire day.

Fig. 1 shows a draughting room illuminated with four type F lamps. The uniformity of the illumination as well as its general intensity and freedom from shadows is well depicted. It is particularly interesting to note that the occupants of the room, even though standing, showing no evidence of movement in the photograph, indicating the short exposure given.

A Plating Room.

The most common commercial electroplating is nickel on to brass or iron. In the latter case the iron is first given a coating of copper; in nearly all cases the metal is given a high polish before undergoing the process. After the nickel has been deposited another polish is required to give the final finish. The more highly polished a surface, the more difficult it is to distinguish its color; in fact, if a surface were perfectly polished, i. e., so that it reflected all of the light thrown upon it, it would have no color. Furthermore, ordinary illumination gives a light of distinctly yellow color. The greenish blue color of the light of the Cooper Hewitt lamp enables one to detect any imperfections in the plated surface, having a tendency to draw through the brass or copper color where the nickel plating is thin or has been buffed off. You can as readily detect these differences in color before the surface is buffed as after buffing. Its low intrinsic brilliancy has an added advantage in all cases where polished surfaces must be handled, since it avoids intense direct reflections, which are as irritating to the eyes as direct light.

Fig. 2 shows an electroplating room

FIG. 2.—COOPER HEWITT ILLUMINATION IN A PLATING ROOM.

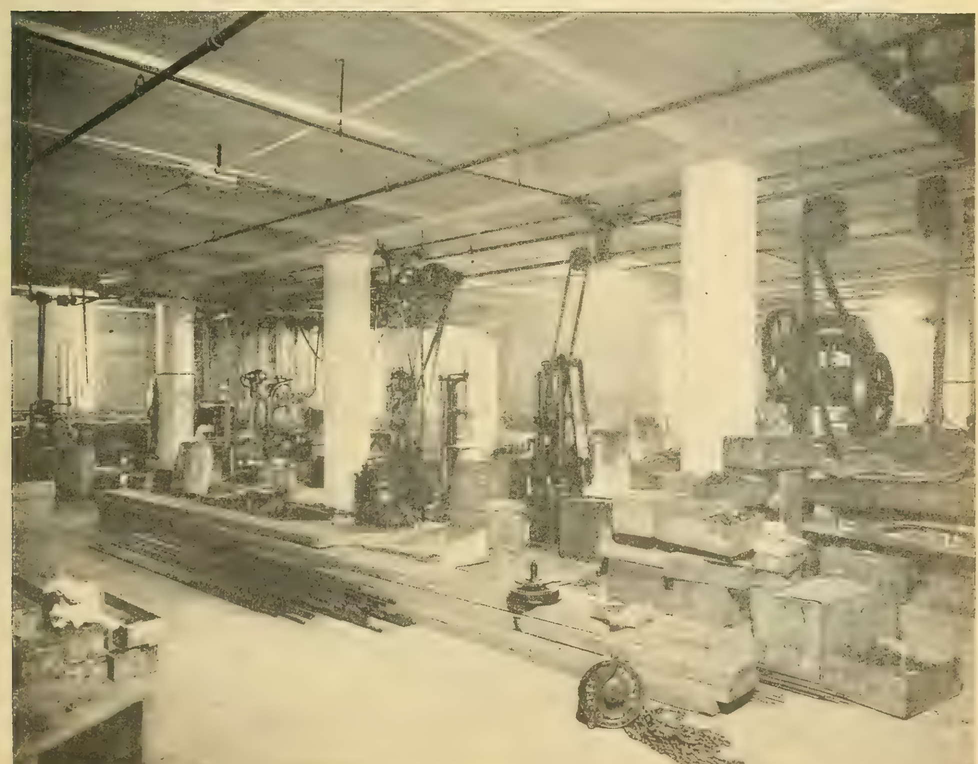

FIG. 3.—PRESS ROOM IN A STAMPING FACTORY BY COOPER HEWITT ILLUMINATION.

lighted with two double tube lamps, only one of which shows in the photograph. The room contains 1596 sq. ft., and the current consumed is 770 watts or .48 watts per square foot.

A Stamping Factory.

The operation of drawing and stamping presses requires an illumination free from sharp or intense shadows in order that the recesses of the die or stamped article may be clearly seen. The principle first annunçiated by Purkinje, that the eye can distinguish details by a lower intensity of green light than by red or yellow, applies to the greenish-blue light of the Cooper Hewitt lamp in rendering objects in partial shadow more clearly visible. For this reason if such illumination is adapted to the peculiar conditions just set forth.

Fig. 3 shows one of the rooms of a large stamping works in Brooklyn. The remarkable clearness of all detail in the room, even in the shadow, illustrates the effect referred to. The room contains 17,000 sq. ft. of floor area and is lighted by fourteen double tube lamps at an expenditure of .32 watts per square foot.

All three photographs were taken by artificial light, as shown by the darkened windows.

A Government Installation of Decorative Lamp Standards

TYPE OF STANDARD USED AT ENTRANCE TO FEDERAL BUILDING, CHICAGO.

The Federal Building in Chicago, which is admittedly one of the finest in the country, has recently had its general impressiveness much enhanced by the installation of sixteen exceptionally handsome bronze lamp standards of the pattern shown in the accompanying cut. There are two of these standards flanking each entrance, and two at the corners of the building. The standards were designed by the supervising architect, Mr. James Knox Taylor. The globes are 26 in. in diameter, of white fish-scale glass, and inclose a 500-watt tungsten lamp.

It will be interesting to recall that this was the first Government building to have its interior lighting designed, or at least revised, by an illuminating engineer, the work being done by Mr. J. E. Woodwell, at the time a supervising engineer for the treasury department. As a result of his work very great economies in the illumination were secured.

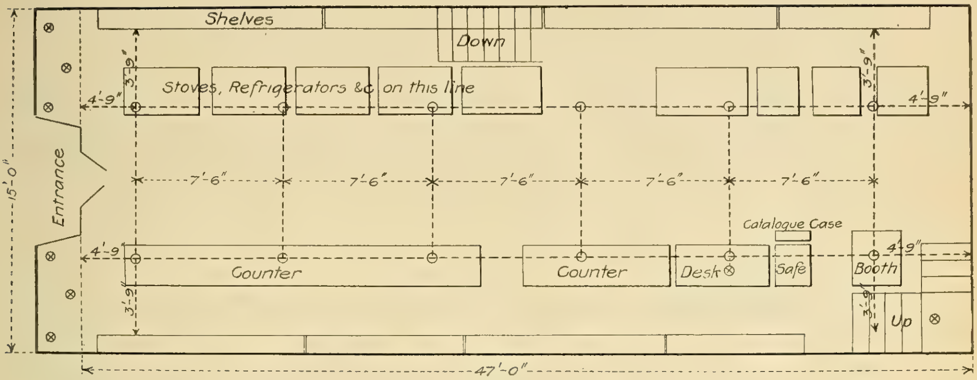

FIG. I.—FLOOR PLAN OF THE STORE.

The Lighting of a Hardware Store

By William A. Murray.

The original installation—that is, the one which was replaced by the work described in this article, was the kind commonly known as a drop-cord outfit, and proved unsatisfactory, partly on account of its appearance, but chiefly because the lamps were arranged in a haphazard fashion in such positions and locations as to produce noticeable bright and dark spots in the illumination. As is common in lamp-cord installations the cord was cut to such a length as to allow the lamp to be at a considerable distance from the ceiling, and "adjusted" at various heights, with the result that there was a noticeably dark streak along the line of the junction of the upper part of the shelving and the ceiling. These defects were to a very large degree removed in the present installation.

The store is 47′ x 15′, with 9′ ceiling, and has plate glass windows in front, the interior arrangement being such as is usually found in stores of its kind. As will be noted by reference to the illustration (Fig. 1), it is arranged with shelving on both sides, a line of counters and show cases on one side, and stoves and seasonable goods placed on the floor on the other side. The light-units are located in the positions shown on the plan, and are one-light fixtures arranged so as to have the lamp near the ceiling, the object being to secure such a distribution of light as would avoid the previously mentioned dark streak along the upper part of the space.

To accommodate the lamps two circuits were run, these extending lengthwise of the store on each side, as shown in the diagram, each circuit being fused independently of the other, so that in case of trouble on one side it would not interfere with the lamps on the other.

Further in explanation of the position of the lamps it will be noted on reference

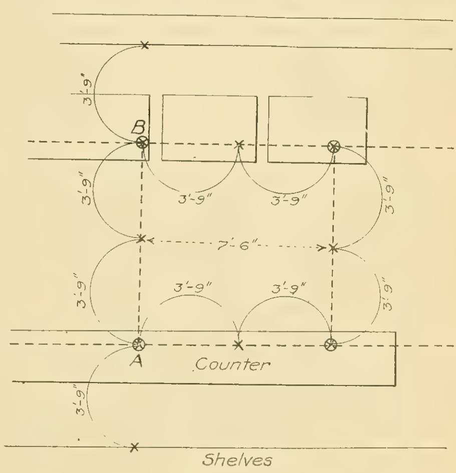

FIG. 2.

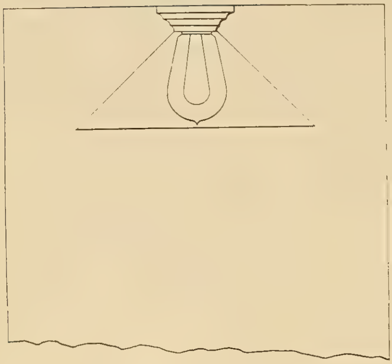

FIG. 3.—UNIT USED IN TELEPHONE BOOTH.

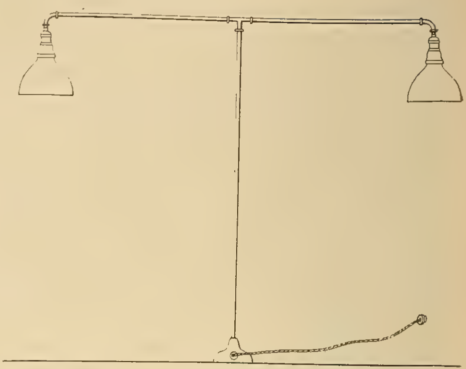

FIG. 4.—TYPE OF UNIT USED FOR WINDOW LIGHTING.

to the diagram that they are so arranged as to have an equal distance of space on each side of the lamps, this being the chief key note of success in the matter of securing a nearly perfect distribution of the light given, and a study of the plan will show this, as on reference to Fig. 2, in which is shown the installation in part, it will be noted that the distance from the shelves to the lamp A is 3′ 9″ and the distance from the lamp A in a straight line to the lamp B is 7′ 6″ and the distance from the shelves to the lamp B is 3′ 9″, the same as on the other side, and likewise the respective distances from lamps A and B to the next lamp on each side of it on the same circuit is also an equal distance, being 7′ 6″. Thus a little consideration will show that the falling strength from one lamp is picked up by the light from the other and thus securing a very desirable feature in good lighting effect, viz., uniformity.

Diagram 2 has been prepared expressly for the purpose of illustrating in a very plain way just what is meant by the statement in equal distance of space on each side of the lamps, and is self-explanatory, as it will be noted that the distance from any two points marked x - x is 3′ 9″ or equal. The lamps used were 16 cp. clear carbon filament lamps, and the windows were lighted by the use of three one-light fixtures, the same as were used in the interior of the store and set as shown on the plan, the lamps being placed at the same distance from the ceiling.

It was known at the time the work was installed that the use of tungsten lamps instead of clear carbon filament lamps would give more light, and it was also known that the plan used for lighting the windows could be considerably improved upon, but those ideas were saved for a future time, when it would be desired to make another improvement in the lighting arrangements.

No doubt it would be a good improvement on the plan described to use tungsten lamps in the window fixtures.

A lamp at the desk was provided by using a desk fixture connected to the outlet just over it.

The telephone booth was lighted by

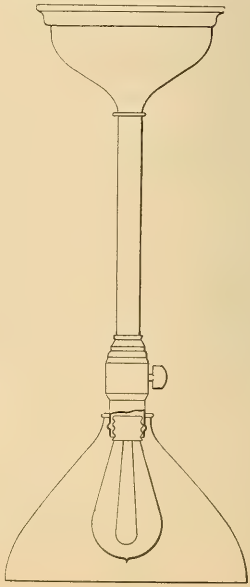

FIG. 5.—TYPE OF UNIT FOR THE GENERAL ILLUMINATION.

means of an 8 cp. clear carbon filament lamp set against the ceiling of the booth and to which was fitted a cone shaped
See illustration Fig. 3.
shade.

A scheme adopted to attract attention at any desired time to either window was to make up a portable lamp, in the form of a two-light fixture, which in this case was made of gas pipes using iron pipe fittings screwed into a suitable base and connected to a convenient receptacle provided for the purpose. This fixture may be set at any point in either window and as may be judged it throws a strong light about in the immediate location wherever it is set. For details of this fixture see Fig. 4.

The Effect of Yellow Glass on the Efficiency of Incandescent Lamps

By Dr. Herbert E. Ives.

A recent discussion in one of the technical societies raised the following question: "To secure the mellow yellow color of the older illuminants, such as the candle, oil and gas, which is more efficient, a high efficiency tungsten lamp behind yellow glass, or a carbon lamp of approximately the desired color?" Although the answer in favor of the tungsten lamp is evident on a little thought, the discussion and figures below may be of some interest and value in cases where this question arises.

First of all it should be emphasized that there is no necessary connection between color and efficiency. A tungsten lamp as operated is whiter than a carbon as operated, and also more efficient. But if both are operated at the same color the tungsten lamp remains more efficient. Color is a matter of the relative intensities of the various colors in the visible spectrum. Efficiency is a matter of the relative amount of radiation in the visible and invisible parts of the spectrum. With most illuminants the invisible radiation is such a large part of the total that a condition can easily be conceived where a ruddy illuminant could be far more efficient than a bluish or white one. Merely strike out all the invisible radiation of the carbon lamp, and it would have an efficiency of 10 candles per watt, which would put the tungsten lamp out of the running.

In the second place, the yellow glass used to make a tungsten lamp look like a carbon acts by absorbing the blue part of the spectrum. Now the blue contains only a small part of the total brightness of the spectrum of an incandescent lamp. In other words, the brightness, which governs the photometric value, is affected less by an absorption in the blue than by an absorption anywhere else, giving the same amount of color change. An absorption in the orange or yellow, on the other hand, would cut seriously into the brightness and therefore into the efficiency.

It is easy to see, then, *a priori,* that the loss in candle-power and efficiency by the use of yellow bulbs or globes can be comparatively small, and may easily be so small as to leave the tungsten with a tinted bulb more efficient than the carbon without. The state of affairs is shown graphically in Fig. 1.

The full curve represents the radiated watts of a normally operated tungsten lamp dispersed into a spectrum, the dotted curve that of a normally operated carbon

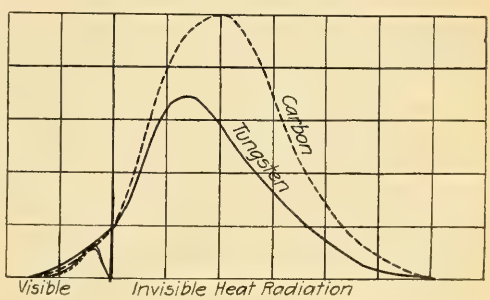

FIG. 1.

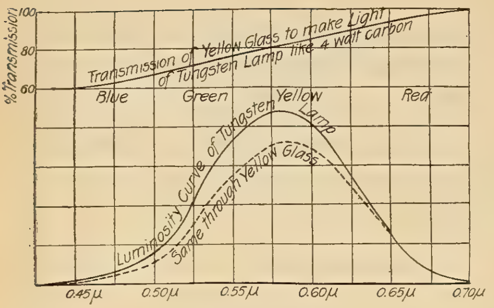

FIG. 2.

lamp. The small included curves are drawn to represent the luminosity values of the visible portions. Their areas are thus proportional to candle-power, while the areas of the large curves are proportional to watts. Now, the effect of a proper yellow glass on the tungsten lamp would be to depress the visible end of its radiation curve to the position of the carbon; that is, the invisible part of the modified tungsten lamp will be the full curve, the visible part the dotted. The effect on the area of the candle-power curve will be small because most of the depression comes at the blue or least luminous end. It may easily be quite too small to overcome the huge advantage of the tungsten lamp in its smaller invisible radiation. Whether this is the case or not a little calculation and experiment will show.

Taking the spectrophotometric values for the relative brightness of the tungsten and carbon lamps color for color through the spectrum gives the necessary absorptions to reduce the former to the color of the latter. These are given in Fig. 2, plotted in such manner that there is no absorption called for at the edge of the visible spectrum in the red 0.70μ, the absorption gradually increasing toward the blue. In the same figure these absorption values are applied to the brightness or luminosity curve of the tungsten lamp. Comparison of the areas of the original and "absorbed" curves tells us that the effect of this yellow glass is to reduce the candle-power of the tungsten lamp by 20 per cent., which is the loss in efficiency for a glass of the ideal character assumed. This is, of course, not nearly enough to overbalance the three-fold greater efficiency of the tungsten lamp.

The case considered is that of reducing the tungsten lamp to exactly the color composition of the "4-watt" carbon, which is about that of the kerosene flame. It would not be necessary, probably, as a rule to hold exactly to this requirement. Merely a yellow light, in general appearance like the old "mellow" illuminants, will usually satisfy, and this can be obtained by absorbing a little blue without touching the green or yellow, the more luminous colors. The loss in brightness due to this kind of "yellowing" would be insignificant.

For the benefit of those to whom these and similar calculations may not be convincing and all sufficient, some figures derived from experiment are here given.

A yellow glass was picked by experiment which upon a photometer produced an approximate match between a carbon lamp and a tungsten lamp over which it was placed. The absorption of this glass was determined by a photometric setting with it and with a clear glass substituted for it. This gave as a result that the desirable yellow 4-watt color could be obtained from a tungsten lamp and yellow bulb with a candle-power loss of 15 per cent. This is obviously a much more efficient way of securing the "mellow," "artistic," "cozy" illumination of our forefathers than reverting to their illuminants.

It is worth bearing in mind in this connection that the difference in color between the carbon lamp and the tungsten is insignificant beside the difference of either from the white of daylight. Perhaps in the long run the most economical solution of the problem is to bear with the more efficient lamp for a while until that marvel of adaptation, the eye, comes to associate the color of the tungsten lamp with home and warmth. Meanwhile if the leap is too great, 1½ watts per candle is certainly better than 4 for the same quality of light.

FIG. I.—DAY AND NIGHT VIEWS OF THE NEW DECORATIVE LIGHTING, WALLA WALLA, WASH.

Ornamental Trolley and Lighting Poles, Walla Walla, Washington

By W. B. Foshay.

In order to furnish the city with an economical installation of ornamental street lighting, and at the same time make the installation one that would be inexpensive to install, the plan for using the iron trolley poles that were already in use in the city was decided upon, and the installation as shown by the accompanying photographs was made.

The trolley poles, which are about 30 ft. high, are constructed of cast iron pipe, the lower section being 20 ft. in length, the top section 10 ft. The lower section is 6-in., while the top section is 4-in. pipe, and a six to four reducer connects the two sections of the pole, while the top of the pole is mounted with a cap that holds a single insulator.

There is an ordinance in the city of Walla Walla which does not permit the installation of any poles on the main streets of the city, with the single exception of these iron trolley poles, and therefore the appearance of the street is ma-

terially aided, and the installation of cluster lights on these poles makes a very pretty installation.

The brackets themselves are made in two sections which clamp around the pole. One section contains two brackets and the other section one bracket, and the two sections are bolted together around the pole. The brackets carry three lights, which are 60-watt tungsten lamps, 115 volts, multiple type. Large alabaster ball globes are used and the fixtures are fed from overhead.

Down each side of the street, mounted on the pin on top of pole above referred to, is a twin conductor carrying two No. 10 wires. A hole is drilled through insulator through which the feeder wire is carried down through center of pole and cluster fed from same.

These clusters have been in use for over four months, and absolutely no trouble has been experienced from the breaking of the filament on account of vibration. No shock absorbers have been used, but the lamps have not been affected in any way and the life of the lamps has been exceptionally good.

In one instance a trolley jumped the trolley wire and hit one of the span wires fastened to one of these poles, shaking one of the large alabaster globes from fixture, which fell to the ground and broke, but the lamp was not affected, and when turned on that night was found to be unharmed.

This method of installing the three-light clusters, as explained above, was accomplished at a cost of a little less than $30 per pole. The city has about decided to install 126 of these clusters, and the prices quoted to the city for such service is as follows:

On three-year contract, $35 per cluster.

On five-year contract, $33 per cluster.

On ten-year contract, $30 per cluster.

The prices quoted include the installation and maintenance, the lamps to be 60-watt tungsten lamps, and the lights to burn from dusk to midnight, with the exception of one cluster to each block, which is to burn all night.

Effective Railroad Depot Illumination in Germany

By K. A. Albrecht.

Every close observer of first impressions realizes that the memory of a brilliantly lighted central depot of a city lingers long in his mind, and recalls easily pleasant incidents connected with the visit to the so distinguished city. American visitors to Germany have a chance to study the illumination of the new Dammtor Railroad Depot in Hamburg as a characteristic incident of an artistic solution of the problem to efficiently and effectively illuminate the approach of this vast and awe-inspiring structure for the accommodation of modern traffic.

Of the first row of four poles each carries one high candle-power flaming arc lamp for the illumination of the lower part of this monumental building, and a second row of two poles each with two flaming arc lamps serves to light up the higher portion of the impressive station. The third row is flanking the street, leading to the depot. Quite novel for the American visitor interested in arc lamp poles are the ones shown on Fig. 1 on stone, or, perhaps, concrete base. The design of the base is in keeping with the general design of the depot, and it carries an iron pole of simple, but well dimensioned proportions, on which the arc lamps are suspended. Something similar has, up to the present day, not been designed in this country, and architects and railroad officials who have an eye for the advertising value, which a well lighted railroad depot always exerts, will undoubtedly profit by the suggestion given in this illustration.

Another idea worth while considering is indicated in the left-hand background. Evidently there is a good-sized park with well-cared for shrubs and trees and flowers, designed to beautify the surroundings of the depot, so making the first impression upon the traveler as favorable as possible,

FIG. I.—DAMMTOR RAILROAD DEPOT, HAMBURG, GERMANY.

FIG. 2.—SAME VIEW AS ABOVE, SHOWING EFFECT OF FLAMING ARC ILLUMINATION.

especially during daytime, when the sun is shedding its glare upon the well kept park.

The flaming arc lamps used in this installation are of the vertical carbon type, radiating a clear white light, which is now universally preferred in the old country, and has conclusively proven its effectiveness in Hamburg, where fogs prevail to a large extent. Two or three years ago Hamburg made a large installation of inclined flame arc lamps, radiating the familiar yellow light, and the authorities believed at that time that yellow was, on account of its penetrating power, the most desirable shade of light advisable. In the meantime, the development of the flame arc carbon, especially that of the so-called white light carbon, has changed conditions materially. It has been observed that the white light carbon is giving just as effective service in fog as the yellow light of the inclined flame carbon type. The reasons are easily found when comparing the spectra of both carbons.

The spectrum of the white carbon ranges over all the colors, from red to ultra-violet, and is the nearest in quality to sunlight. The light of the inclined yellow carbon contains colors from red to green only, and is especially rich of red and yellow rays. The blue part of the spectrum is entirely missing, and this is the reason why the yellow is so pronounced. In both spectra, however, the intensity in the red-green part is about alike. In foggy weather, the short waved rays, that is the blue to the violet, will be absorbed, but the rays coming from the red to the green part of the spectrum penetrate fog in the same measure as the rays coming from the spectrum of the old type yellow inclined carbon flame lamp. This is the reason why the white carbons are giving perfect satisfaction in all weather.

The lamps used are burning two in series on 110 volts D. C., taking 10 amperes with about 40 volts on the arc, and emitting 2500 mean hemispherical candle-power per lamp. Proper arrangements are made for lowering the lamp so that they can conveniently be trimmed and cleaned. If we compare the installation pictured with that of a new railroad depot in New York, we cannot help but admit that this German solution of railroad depot illumination is the superior one, and worth being taken into consideration by our architects, responsible for the appearance of our large depots.

Ocular Research Suggestions

By Albert Jackson Marshall.

The study of the effect of light on the eye is not only one of the most fascinating phases of the use of light *but is likewise the most important*. During the last few years much has been learned of this most important phase of lighting, but there yet remains a number of points on which information—*authentic data*—is needed. In this brief article I will attempt to point out but three of the many conditions which I feel well worthy of thought and investigation.

The first consideration I have in mind: What is the effect of light-sources of high intrinsic brilliancy on the eye? We hear much about the highly detrimental effect of brilliant light-sources exposed to the field of vision, and I think that, for the most part, we are universally agreed that such practice is undesirable. It is interesting, however, to note how some people work with their eyes exposed to glaring light-sources with comparatively little ill effects: I want it understood that *I do not say that there is no ill effect,* but apparently the persons' eyes, so exposed, are not seriously inconvenienced, at least, for the work they perform.

The first class I will refer to are the people of the stage—actors and actresses who, in their working hours, expose their eyes to footlights, calcium and spot lights or to unshaded lamps placed close to the sides of their faces in their dressing-rooms when "making up." I have made inquiries among a number of these theat-

rical people and find, for the most part, that they are blest with comparatively good visualizing organs. Some data from oculists regarding the use of glasses among these people, prevalent eye diseases, etc., would be of value.

Special Operations in Which the Operatives' Eyes Are Subjected to Intense Glare.

Another class whose eyes are subjected to intense light are those people who are employed in incandescent electric lamp factories where aging of lamps and exhaustion of bulbs is accomplished. These latter mentioned workers' eyes are ofttimes held within less than 1 ft. of a row of clear lamps, which are burned momentarily at high (above normal) voltage, giving rise to light of an exceedingly high intrinsic brilliancy, approaching the so-called "white" light. Even when the lamps being tested are operated at normal voltage an intrinsic brilliancy of approximately 1000 c.-p. per square inch is ofttimes obtained, also in exhausting lamp bulbs the eye is subjected to "blues" and "pinks," which, while being less intense than the effect caused by a high voltage on the lamp filaments, is trying, and may leave its distinct after ill effects. These workers do not seem to experience any great difficulties from such exposures; in fact, I have been greatly surprised at the apparently healthy (judged purely from casual observation) conditon of their eyes. Somewhat similar to such conditions, although dealing with sources perhaps less intense, but having greater area, is the effect of semi-molten metals and glass upon those whose eyes come in close proximity to such mass. To what extent, however, the eye is permanently injured by such cases is yet to be determined.

It probably would be of value to know what would be the ultimate result if the eye was called upon to visualize, for extended periods, when subjected to such conditions—whether through its efforts to adjust itself to same—excluding light from the retina principally through the agency of the iris and attempting to "see" something, such as, for instance, newspaper print—if the strain of such effect would not be highly injurious. During working hours the individual accommodates the eye to excessive brilliancies and afterwards uses the eye for reading purposes under more or less ideal lighting conditions: do eyes subjected to such conditions require, as a rule, for reading, lower or higher illumination intensities than the average eye operating under normal conditions, and can such an eye visualize as easily and accurately as the normal eye?

Indirect Lighting.

Second: What is the permanent or ultimate effect on the eye of comparatively large areas illuminated to a few foot candles intensity, where the surface may be to the left or right, below or above, the eye or a combination of all, or part, of such surfaces? We all perhaps have had, to a greater or lesser extent, some experience with the effect of light reflected from the snow-covered ground; we know the experience was *not* agreeable. Some of us have had the experience of working or resting (attempted) under so-called indirect lighting, where the maximum flux of light from the source is directed to the ceiling, and in some cases to the upper side walls, where, after a certain percentage is absorbed, depending on the nature of the secondary reflecting surface or surfaces, the remainder is received on the working plane. The effect produced by such use of light is not greatly unlike the effect of light reflected from snow, unless it be that the upper part, instead of the lower part of the eye, is affected. *There is little or no authentic data as to the effect of such usage on the eye,* although we in many cases easily appreciate its momentary aggravating and depressing effect; also the difficulty experienced in attempting to visualize. While with such system high intrinsic brilliancies of the sources are avoided, yet the resultant effect—namely, large areas brightly illuminated—is effected which may be injurious (permanently) to the eyes. Data, based on intelligent, unbiased investigations, is greatly needed—not commercial sales talk. In investigating the effects of indirect lighting upon the eyes it would be desirable to also ascertain the effect of semi-direct lighting results where the lighting units, instead of employing opaque redirecting surfaces,

will consist of surfaces which are at once transmittive and reflective. This system appears to be a happy medium between the purely direct and indirect.

EFFECT OF MONOCHROMATIC LIGHT.

The third condition is the effect of light on the eye as produced by illuminants of high selective emission, such as, for instance, the mercury vapor lamp. It is assumed that different parts of the retina are especially tuned to various rates of light vibrations, the stimulating influence of which, when communicated to the brain through the agency of the optic nerve, gives rise to the sensation of vision. The eye has for the most part been developed under daylight conditions. While the spectra value of daylight varies with the coming and going of the day and with different climatic conditions, yet at no time is the spectra of daylight nearly so highly selective as that obtained from the aforementioned illuminant, the predominating color of which is greenish-blue. If the eye is subjected for long periods of time to the rays of an illuminant which is efficient in many bands of the spectrum, thereby exercising only those portions of the retina that are attuned to the restricted vibrations caused by such illuminant, with little or no exercise for those portions of the retina attuned to extended vibrations of the more continuous spectra of natural light, the eye may be overstimulated in certain parts and understimulated in others. It appears that, due to the exciting influence of selective emission of this illuminant on certain parts of the retina, the visualizing ability of the eye, for detail, is stimulated much like a runner may, through the excessive use of oxygen, do greater work for short periods. What are the after-effects of this overstimulation? To judge by other effects due to stimulations—drugs and oxygen as used as aforementioned on the body—it would appear injurious. It usually is unwise to force Nature. We can't have more than 100 per cent. of anything. If we give to one, we take from the other. How will such adjustment affect the eye?

If the eye is subjected to these conditions for lengthy periods certain parts of the retina may become overdeveloped, due to excessive usage (if they do not break down from overwork) and other parts may waste away through lack of usage. It would, no doubt, be interesting for oculists to make extended tests on persons' eyes who work under such illuminants with a view of ascertaining what effect such emission has on the eye—how the eye operates under such light values? How eyes used by such illumination respond to natural light and illumination? How eyes used by such illumination respond to light and illumination produced by incandescent electric and gas lamps, such as would be employed in the average home, where we assume the workman's eyes will be used as well as in the factory. In operating under such color values is permanent or prolonged injury being done, and if one who has been working under such conditions for an extended period would experience any difficulty in adjusting his eyes if he had to change his place of work where other than such highly selective illuminants were used.

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FIG. I.—DAY AND NIGHT VIEWS OF TUNGSTEN "WHITE WAY" IN VIRGINIA, MINN.

Decorative Public Lighting Continues to Grow In Public Favor

Some Recent Examples of Civic Pride and Enterprise

However men may differ in their political views and affiliations; whether they "stand pat" or "insurge"; whether they believe in municipal government by commission or by political rings, there is one thing in relation to which all differences are forgotten and all opinions unite, and that is public improvements which "boost" the city as a whole.

Of the many reform administrations which have come and gone in New York City, few have left any important permanent results. As an exception to this rule, there was one that performed the Herculean task of cleaning up the streets, and this particular reform has persisted through all political changes to this day. The citizens, having had a practical experience in the material advantages and personal comfort of clean streets, no administration since has ever dared to tempt public indignation by even a partial return to the conditions of filth that existed in pre-reform days. New York City is today probably the cleanest metropolis in the world, and it will never again become filthy.

The same principal applies to public lighting. It is one of the utilities whose advantages are so conspicuous, and which so directly affects the personal comfort of every citizen that, having once been improved, relapse is impossible. It is an improvement which once begun can have but one outcome—continual progress. The advantages of good public lighting

are more than local, as is plainly shown by the continued spread of the movement throughout the numerous cities and towns of the country.

Some examples of recent noteworthy installations will serve to illustrate this point:

THE CITY OF VIRGINIA, MINN.

Virginia is a town claiming something over 13,500 population. On the first of Setpember it put into service a complete installation of tungsten cluster lamp posts on its principal thoroughfare. The posts are of handsome design, each supporting five 100-watt tungsten lamps, four on the arms and one in the center, as shown in the illustration. The posts are placed 80 ft. apart. All lamps are burned until 12 o'clock, when the four on the arms are switched out, leaving the central lamp in service. Night and day views of the installation are shown in the accompanying cut. (Fig. 1.)

It is easy to credit the statement of the local central station that "the system is extremely efficient as a form of lighting, highly pleasing to everybody, and generally satisfactory," and that "it would be impossible to find anybody in the town who would be willing to go back to the old form of arc lighting at any cost."

PUEBLO, COLO.

Pueblo was one of the early mining settlements of Colorado, and is one of its best known cities to-day. It has recently put in an extensive decorative lighting installation, which the citizens refer to as the "Great White Way of the West."

This installation differs from the majority of "white ways" in using regenerative flaming arc lamps instead of tungsten clusters. These are placed on comparatively high poles 150 ft. apart along each curb. The illustration, Fig. 2, shows a night view on the principal street in the business district. Particular note should be taken of the high degree of luminous intensity on the pavement, all details showing as clearly as by daylight. There is no doubt that where brilliantly lighted pavements and store fronts are the objects sought the regenerative flaming arc is without a peer among modern electric illuminants.

This installation is the result of private enterprise. The merchants that contributed to the installation are said to be

FIG. 2.—A "WHITE WAY" OF REGENERATIVE FLAME ARC LAMPS, PUEBLO, COLO.

FIG. 3.—THE "WHITE WAY," NASHWAUK, MINN.

highly pleased with the results from the purely investment standpoint, their business having largely increased since the installation was put into service.

The Village of Nashwauk, Minn.

Many interesting examples have been given in these pages from time to time of the remarkable enterprise shown by small towns in the way of decorative public lighting. If we were to offer a prize for the smallest town having a real "White Way" the village of Nashwauk, Minn., would be the winner, so far as present information goes.

This village is credited with only 684 population (in 1900), and yet has an installation, consisting of twenty-two handsome iron lamp standards, each supporting three tungsten lamps. A portion of the "White Way" is shown in Fig. 3. Owing to the topography of the street part of the system is hidden from view. The central lamp is of the 60-watt size and the two on the arms 40 watts, fitted with 12 and 9 in. globes, respectively. Underground cable is used for the current supply, and an ingenious system of wiring used by which almost any possible combination of lamps and posts can be put into service.

The three lamps are burned normally until midnight, when the two on the arms are extinguished and the central light left burning throughout the night.

There are four standards to the block, which spaces them about 95 ft. apart. Mr. George A. Lindsay, the superintendent of the village electric plant, states that they expect to put five lights on these posts in the spring and then extend the three-light posts down the side streets. How is this for enterprise in public lighting?

Milwaukee, Wis.

So much has been heard of the newer forms of arc and incandescent lamps in decorative street lighting that one might suppose that the inclosed carbon arc, which has served so long and faithfully as a street illuminant, had been entirely superseded by the later forms. Such, however, is not the case. Some of the finest installations of street lighting in this country to-day consist of this form of lamp. Philadelphia and New York offer perhaps the most extensive cases of this system.

A special example, showing some of the possibilities of this type of lamp for decorative lighting, is illustrated in Fig. 5. This shows a night view of the building of the Milwaukee Electric Railway & Light Company. A day view (Fig. 4) shows the detail of the lamp post more distinctly. As will be seen, each post carries three inclosed arc lamps and is of a neat and ornamental design. The posts are placed near together and the general effect at night is brilliant but not dazzling. The uniformly high degree of illumination on the pavement and on the lower face of the building is clearly shown in the night view.

St. Louis, Mo.

A record of the movement for better public lighting in this city, which met with so prompt a response on the part of its leading merchants and business men, has already been given in these pages. A brief description of the installation, however, and a night view showing the actual results obtained will nevertheless be of interest.

The installation is noteworthy as being one of the early extensive uses of the magnetite or luminous arc lamp for this purpose. This form of lamp was chosen after the City Improvement Association, which had the matter in charge, had made an exhaustive personal inspection of the various prominent decorative lighting systems throughout the country. A year's opinion of those most interested in the use has fully justified their choice in the results, general satisfaction being expressed from both the commercial and esthetic standpoints.

FIG. 4.—DAY VIEW PUBLIC SERVICE BUILDING, MILWAUKEE.

FIG. 5.—PUBLIC SERVICE BUILDING, MILWAUKEE, SHOWING NIGHT ILLUMINATION.

FIG. 6.—NIGHT ILLUMINATION, BROADWAY, ST. LOUIS.

FIG. 7.—ORNAMENTAL ARC STANDARD, BROADWAY, ST. LOUIS.

TOLEDO, OHIO.

It would be misleading to speak of Toledo as having a "Great White Way," since this expression signifies a single street, or section of street, equipped with special lighting. If the term is to be used at all we should rather speak of Toledo's "Great White District," since its special lighting includes the entire business section of the city, as will be seen by referring to the map shown in Fig. 9. In this section are installed something over 2500 luminous arc lamps. The lamps are suspended from ornamental iron poles, as shown in Fig. 8.

This is one of the largest installations of this type of lamp that has ever been put in, and has attracted attention all over the country, many representatives of municipalities and civic associations having visited the city for the purpose of inspecting the installation and the results obtained. In more than one case such an inspection has resulted in an unqualified recommendation by the visitors of the magnetite arc for use in their own cities.

The long life of the electrodes is one of the most important economic advantages of this type of lamp, a peculiarity being

FIG. 8.—ORNAMENTAL ARC LIGHTING STANDARD, TOLEDO, OHIO, MAGNETITE LAMPS.

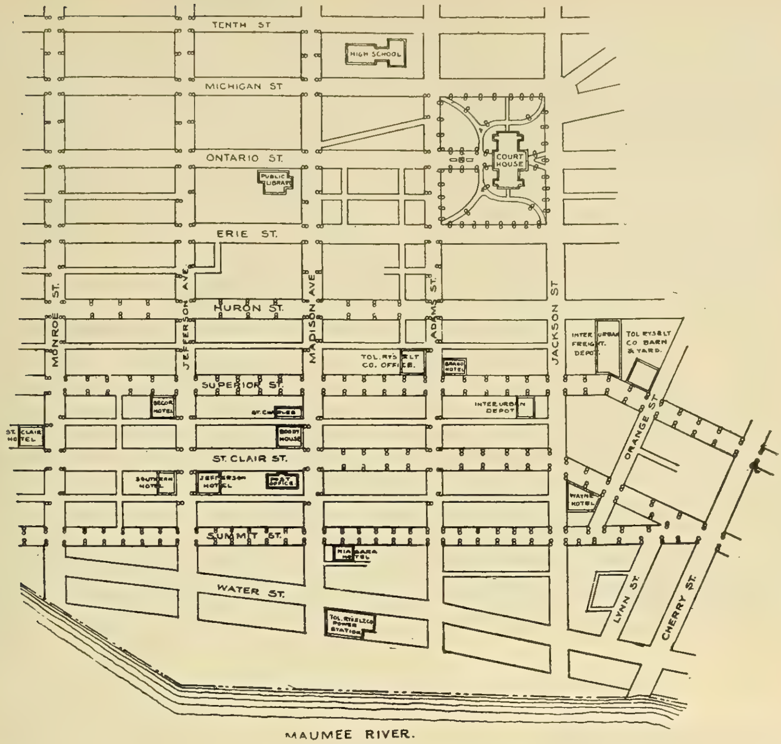


FIG. 9.—TOPOGRAPHICAL MAP OF BUSINESS SECTION OF TOLEDO, SHOWING SECTION LIGHTED BY NEW ORNAMENTAL LIGHTING.

the fact that the upper electrode needs renewing only about once in two years, while the lower has a life of approximately 170 hours. It is stated that one man can take care of about 250 lamps. The lamps are run on direct current produced by a "rectifier" system, which has given excellent service in this case, the average life of the tubes being given as 890 hours.

St. Paul, Minn.

St. Paul has a fine installation of modern ornamental street lighting. A typical lamp-post is shown in Fig. 12, of which there are eight in each block, four on either side of the street. There are over 300 of these in the downtown section, 100 of which have been added during the past year.

But St. Paul apparently is not one of the believers in "letting well enough alone," as, handsome as this lighting system is, it is enormously enhanced by special illuminating features during the holiday season and other festive occasions. This special illumination, moreover, is not left to the whim of the occasion, but is provided for by permanent arrangements.

Fig. 11 shows one of the most unique decorations in street lighting that has ever come to our notice. This is in the shape of elaborate festoons draped on the lamp-post. One hundred and fifty posts were thus decorated during the past holiday season.

Connecting each pair of posts thus decorated another festoon was stretched over the street, as shown in Fig. 10. Each of these contained 52 8-c.-p. carbon lamps, with a metal circle in the center outlined with 16 8-c.-p. lamps. This circle is especially intended for displaying an emblem or device suggestive of any special festivity for which the illumination may be provided.

This decorative illumination attracts enormous throngs of citizens and of visitors from out of town, among the latter being many merchants and others who

FIG. 10.—ST. PAUL, MINN., SHOWING EFFECT OF THE DECORATIVE FESTOONS IN CONJUNCTION WITH THE ORNAMENTAL POST LIGHTING.

FIG. 11.—ANOTHER VIEW OF ST. PAUL, SHOWING THE EFFECT OF THE CHRISTMAS GREENS, WITH THE ORNAMENTAL POSTS.

FIG. 12.—TYPE OF STANDARD USED IN ST. PAUL.

combine business with pleasure by making purchases during their sojourn in the city. Merchants and business men in general are unanimous in their opinion that the new lighting has done more to advertise the city and stimulate trade than any other single agency.

Chicago, Ill.

Michigan Boulevard, the city's pet thoroughfare—and justly so, for it has one of the finest natural locations of any street in the world—has been used as a sort of practical laboratory for the trying out of various methods of decorative lighting. The South Park Commissioners, having jurisdiction in the case, have decided upon the use of the tungsten cluster system.

The post chosen is shown in the illustration, Fig. 13. It is of neat but very tasteful design, and supports six lamps in a pendant position.

Pittsburgh, Pa.

Pittsburgh has long possessed a spectacular method of lighting, which in the magnificence of its effects makes the most powerful modern electric lamp look like a tallow dip. A single one of these light-sources is so powerful that we have personally observed a distinct shadow cast by the rays reflected from the clouds at a distance of three miles. The unit, however, is scarcely suitable for street illumination, being the apparatus commonly known as the Bessemer converter. But one who has never witnessed the operation of this apparatus at night has but a faint conception of the dazzling glory of the illumination produced.

Pittsburgh has within the year converted its widest business thoroughfare, Liberty avenue, into a "Great White Way." This has been accomplished by an installation of magnetite arc lamps of the larger size. These lamps are suspended from specially constructed mast arms attached to the iron trolley poles. This arrangement gives two lamps on opposite sides of the streets at an average dis-

FIG. 13.—ORNAMENTAL LAMP STANDARD TO BE USED ON MICHIGAN BOULEVARD, CHICAGO.

FIG. 14.—LIBERTY AVENUE, PITTSBURGH'S "GREAT WHITE WAY."

tance of 90 ft. from lamp to lamp. The lamps are placed about 28 ft. from the pavement.

The installation has created much favorable comment on the part of the public, and a demand for similar illumination in other parts of the city.

A night view of the street was shown on the front cover of our last issue.

Ogden, Utah.

A new street has been recently created in this prosperous town, having been cut directly through the middle of a block. It is altogether fitting that a new street should have a new system of lighting, and so an installation of modern decorative lamp posts supporting clusters of tungsten lamps has been put in. The posts were constructed by a local manufacturer, and are equipped with five lamps, one 60-watt supported pendant at the extremity of each arm, and one 100-watt at the top. The lamps are 110-volt multiple, and are inclosed in spherical globes roughed inside. The posts are spaced 132 ft. apart.

Daylight and night views of the street are shown in the illustration.

FIG. 15.—TYPE OF STANDARD USED AT OGDEN, UTAH.

FIG. 16.—DAY AND NIGHT VIEWS OF THE NEW ORNAMENTAL LIGHTING, OGDEN, UTAH.

It is the purpose to make this street the best lighted in the city, and if the results prove satisfactory the system will undoubtedly be extended to other streets.

Indirect Illumination

A New Method of Lighting a Theatre Auditorium

By Augustus D. Curtis.

The disagreeable properties of exposed direct lighting sources are well recognized by theatrical men. As shown by the handling of stage lighting, men in the business realize more than any other that where there are direct lighting units in the range of vision the seeing effect is greatly diminished, and, in consequence, an exposed light is seldom used on the stage.

Exposed lights anywhere in the auditorium are nearly as objectionable. Some authorities claim that one 16 candle power bulb in range of vision decreases the ability to see about 25 per cent. Therefore, the solution of theatre auditorium lighting is by indirect illumination.

Especially for moving picture theatres it seems to be just what owners have been looking for. Doing away with exposed side and ceiling lights and giving an illumination that does not interfere with showing and seeing the pictures, one can appreciate its great desirability.

The system is elastic. Any desired intensity can be secured. In case a very dim light throughout the auditorium during the progress of the show is desired, one or two lamps can be left burning, and

the illumination secured from these will be evenly diffused throughout the house.

Numerous installations in theatres and auditoriums have proved, and it is acknowledged by architects and owners who have investigated, that indirect lighting has overcome the serious objection to exposed light units and solved the difficult problem of theatre auditorium illumination.

The recent opening of the Plaza Theatre, on North Avenue, near Wells Street, Chicago, marked what is believed to be an epoch in theatre illumination, it being the first extensive use of indirect lighting in a theatre auditorium. It also shows the important influence of good lighting on the success of a theatre.

This amusement house is less than a year old. The building is devoted exclusively to theatrical purposes, and was erected as nearly fireproof as possible, brick, concrete and steel being used almost entirely; in every way it conformed to the strict requirements of the city building ordinances relating to theatres. However, it was lacking in several features to make it a cozy and popular house. After several changes of management it was made evident that extensive alterations were necessary to provide the auditorium with more adequate light and heat, more perfect acoustics and more cheerful decorations. This remodeling was carried out last summer, and on the opening night, October 17, a practically new theatre was revealed that was bright, warm and attractive in every sense.

The Plaza Theatre is one of the outlying theatres producing refined vaudeville at low prices that are now becoming so popular. It has a seating capacity of 1477, over a third of the seats being in the balcony. Since the remodeling of the theatre it has enjoyed a much greater patronage, the credit for a large part of which is evidently due to the improved lighting. With the indirect system the wiring is greatly simplified and a relatively small number of high-efficiency

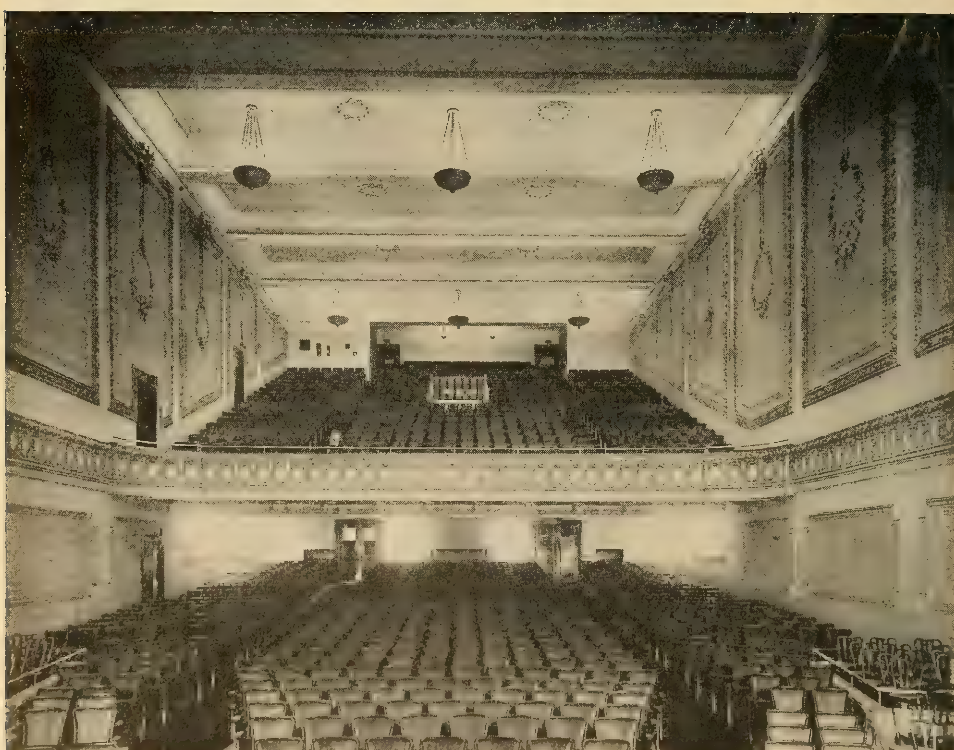


FIG. I.—PLAZA THEATRE, CHICAGO, BY INDIRECT ILLUMINATION.

lamps can be used. In theatres of the class under consideration, it is customary to keep the auditorium lighted during a considerable part of the performance; in fact, in New York all moving picture shows are required to be produced with the auditorium lights on. The lighting for an audience under such circumstances should be restful and entirely free from glare. This is conspicuously true of the indirect system. Under it the eye can follow the performance without being distracted by any brilliant light sources. The actors can see their audience without the uncomfortable glare from direct lights.

In view of these considerations it was decided to employ the indirect system as far as possible. The main ceiling was so equipped, also the foyer. In the parquet circle, directly under the balcony, it was feared that there was not enough headroom for indirect units, and, as this had been the best lighted part of the house, the eight original brackets, each bearing three 60-watt pendant lamps, were retained. Although these lamps are provided with milk-glass shades the contrast between the illumination in this part of the house and that in the parquet proper, and in the balcony, is striking. The accompanying view from the stage illustrates this clearly.

The main ceiling of this theatre has six long rectangular panels running crosswise of the house. Although this architectural design was not particularly suited to indirect lighting, the latter has been quite successfully adapted to it. If this lighting system had been contemplated originally, the panels might quite readily have been made nearly square, so as to place an indirect fixture at the center of each, thus giving a uniform lighting of the ceiling and avoiding the alternate bright and dark panels to be seen in the accompanying views. However, even under the present arrangements, the actual illumination of the seats throughout the parquet and balcony is quite uniform, adequate and satisfactory.

There are nine main indirect fixtures arranged in groups of three to a panel in the first, third and sixth panels from the stage. Each fixture is suspended by four chains, and is of an ornamental character, harmonizing with the decorative scheme. The fixtures in the first two rows each contain six individual units and are hung with the center of the units 5 ft. below the ceiling. The row of three fixtures above the back of the balcony holds four units each of the same type, but placed nearer to the ceiling. Each indirect unit consists of a 100-watt tungsten lamp set with tip up in an independent distributing type reflector with corrugated and silvered surface, these reflectors being entirely screened from view by the ornamental fixture, which has an internal diameter of 32 in. and a depth of nearly 16 in. over all. A good idea of these fixtures may be obtained from the accompanying illustration. The ceiling is 49 ft. above the main floor, and the width and length of the auditorium are 49 x 105 ft. The energy expended in the nine main fixtures is 4800 watts, or 0.935 watt per square foot. The illumination at the seats was calculated as being 2.3 foot-candles.

In the southeast corner of the balcony is a fireproof room for the moving picture and spot-light equipment, which reduces the width of the seating capacity at the rear. Over this portion of the balcony two small indirect lighting fixtures were placed; each of these had a 100-watt tungsten lamp with its reflector. On each of the side walls of the balcony three three-light brackets, like those below the balcony and originally in place, were left, but these are entirely superfluous, as the indirect units supply an abundance of light. In next to the rear ceiling panel is a row of eleven emergency lights on a separate circuit controlled from the box office; these are required by the city ordinance. Under the front edge of the balcony is a similar row.

For lighting the proscenium arch five 100-watt tungsten lamps were mounted in "scoop" reflectors that were set in flush in the ledge at the base of the arch on each side, thus giving an indirect cove-lighting effect to the arch.

In the foyer of the theatre three indirect fixtures were provided. Each of these holds two 100-watt tungstens set in individual distributing-type reflectors. The bowl is of spun brass 18 in. in diameter and 10 in. deep, with an ornamental band at its top. In the foyer there is a vaulted ceiling and the fixtures are suspended 42 in. below this. The dimensions of the foyer are 10 x 49 ft., so that

there is an expenditure of 1.22 watts per square foot of floor area, which produces a calculated illumination of 3.1 foot-candles.

The entrance lobby of the theatre is lighted by means of a combined direct and indirect fixture. Suspended by chains from the ceiling is a canopy holding six 100-watt lamps with their individual indirect reflectors. In the centre of the canopy is an opal ceiling bowl fitted with three lamps. Suspended from the edge of the canopy are eighteed pendant frosted lamps. This fixture is quite attractive. At the edge of the canopy in front of the theatre are 34 tungsten lamps in opal globes. On the front of the building are six flaming arc lamps. With the exception of the latter, all the lamps in the parts of the theatre described are tungsten lamps.

An Unusual Example of Spectacular Lighting

By Manfred A. Pakas.

Minneapolis enjoys the distinction of having one of the most decorative and extensive street lighting systems in this country, but large as it is, it was made to look like the glowing end of a cigarette in comparison with a flaming arc lamp by a special exhibition of spectacular lighting, which was not scheduled by the Publicity Club—and this lighting was by the ancient flame light-source at that. The flames originated in, and were luckily confined to the Syndicate Building, one of the large modern business structures of the city. One of the most curious incidents connected with the exhibition was the decorative cluster lamp posts, which stood their ground on the curb in spite of a heat so intense that it kept the firemen scores of feet away, not even the glass globes suffering from the ordeal.

The illustration shows the fire in its later stages, with two jets from the fire hose playing around one of the standards.

This is a good object lesson on a point that we have frequently maintained, that it is poor economy to put in anything in the way of street lamp posts but the best that can be obtained. The whole installation around this building will only need repainting, and the replacing of a single broken globe, to be in as good shape as when installed.

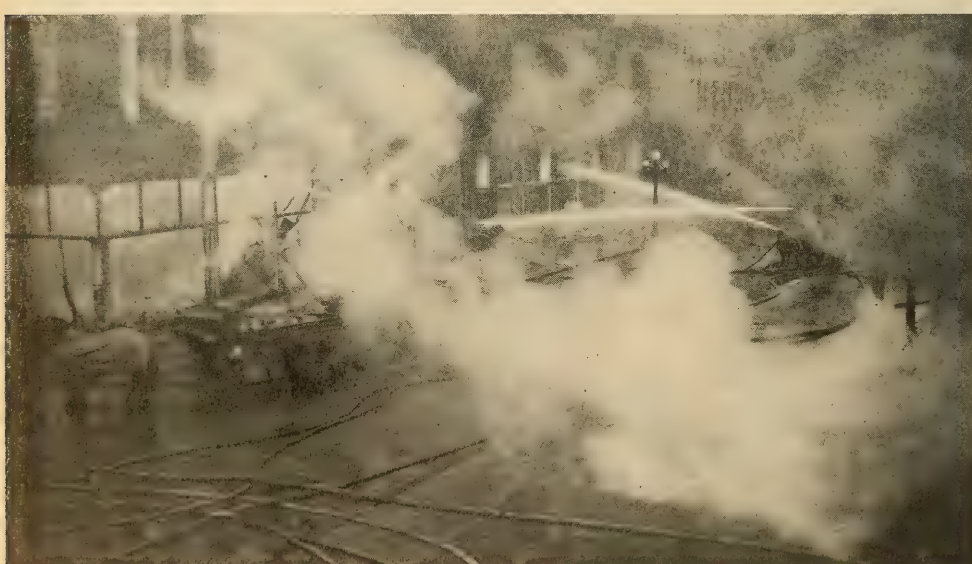
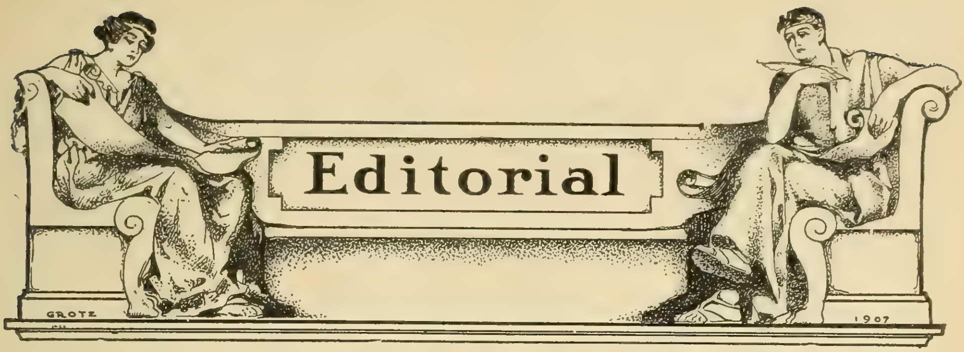


FIG. 1.—VIEW OF THE RECENT FIRE, MINNEAPOLIS, SHOWING THE ORNAMENTAL LAMP-POSTS.



Commercialism in Scientific Literature

There is probably no more delicate or difficult question that continually confronts the editor or publisher of a scientific magazine—or perhaps any other, for that matter—than drawing the line between the commercial and the legitimately scientific treatment of the subject matter of the periodical. The scientist to-day, if he does not actually work to the definite end of producing commercial results, is at least on the alert for any idea that may have an ultimate money value; and even though he does not consciously aim to give an advertising turn to his writing, will naturally and unconsciously present his proposition in the most favorable light possible. The inventor is by nature an enthusiastic in regard to his own inventions, and it is as easy for him to overstate their merits and gloss over their weaknesses as for the parent to admire his own child. On the other hand, the advertising value of statements made in the course of a reading article are fully known to those engaged in the selling end of the business, and there are plenty who are watching for just these opportunities for free advertising.

The fact must also be admitted, regrettable as it is, that there is no small tendency on the part of the technical press to connive at such exploitation on the part of their advertising patrons. Again, the fact must be equally borne in mind that the ultimate value of any invention or idea is measurable in dollars and cents; in other words, the usefulness of a thing is measured by its market value. To cut out all descriptions or references that have an indirect commercial value would therefore be to emasculate an article beyond all hope of usefulness.

These observations are by way of preamble to a letter received from an illuminating engineer whose ability and high sense of professional ethics make his opinions especially worth heeding:

Editor THE ILLUMINATING ENGINEER:

As others have been doing, I should like to congratulate you on the recent anniversary of THE ILLUMINATING ENGINEER, and to express my appreciation of the good work that the magazine has done and is doing. At the same time I notice a regrettable tendency among some of your contributors to use your columns for articles which are too evidently commercial, and, as an example of this, I would especially point to the edition of February, 1911. The type of article to which I refer is, generally speaking, one which purports to give results of tests, but fails to give such an account of the tests that any proper judgment can be made in regard to their accuracy.

The article in your February issue, by J. H. Campbell, is a glaring instance of this, and I note that, since it came to my attention, objection has been raised to it in your March issue by Mr. Fugate. Mr. Fugate's objections are the result of special knowledge in regard to the circumstances. Nevertheless, in a general way, I think the article is objectionable on account of the results being entirely unsupported by any proper evidence.

I would also refer to the article by Mr. Kilmer in the same issue. In this article he makes the following statement:

"Illuminometer measurements made on a plane 30 in. from the floor show an average value of 2.8 foot-candles, with a maximum of 2.85 and a minimum of 2.7. This variation is perceptible to the eye and affords a means of rest, as the eye soon becomes weary when subjected to a uniform illumination."

I think you will agree with me that if an

average illumination of 2.8 foot-candles were obtained, and the maximum deviation from the average were only 0.1 of a foot-candle, the illumination must have been remarkably uniform, and it is most astonishing that the variation should be perceptible to the eye. I believe, therefore, that any competent illuminating engineer would very strongly doubt what Mr. Kilmer says, and would believe that either the measurements were in error or that the variation perceptible to the eye was not a variation in illumination—that is, in flux density received on the plane.

I would also call your attention to the article by Mr. Augustus D. Curtis in which he states, on page 637, "The average illumination is approximately 2½ foot-candles." Mr. Curtis does not vouchsafe any further information in regard to this statement, and the reader does not know, therefore, whether this figure was obtained from tests, calculation or by guesswork.

Further, there is the unsupported statement of Messrs. Godinez and Marshall, also in your February issue, page 622, in regard to a certain ballroom in the West. This statement has been objected to in your March issue by Mr. Wheeler.

Yours very truly,
J. S. Codman.

We commend Mr. Codman's letter to all contributors, or those who contemplate contributing, to the technical press. Science is nothing if not accurate; and contrary to the proverb, figures are the most facile of all liars. Misstatements, or facts stated so as to lead to erroneous conclusions, harm nobody so much as their author; they are modern instances of the fable of the boy who cried "Wolf, wolf"; they destroy confidence.

We can hardly agree with Mr. Codman as to a statement of bare facts being objectionable when unsupported by other evidence. Generally speaking, the scientist must be taken absolutely at his word; there *is* no supporting evidence. More than one capital sentence has been passed upon the simple statement of the results of a chemical analysis. An author who presents figures which are *prima facie* correct is entitled to have them published under his signature, at least until convicted of deliberate misrepresentation. The author of a signed article assumes all responsibility for his statements, so long as they are not libelous. At the same time Mr. Codman's points are generally well taken; an author should for his own reputation, as well as for the good of his profession, use all possible precautions as to accuracy in the statement of facts and figures.

Suggestions for Ocular Research

In another section of this issue Mr. Albert Jackson Marshall presents several interesting problems as proper matter for research. Stripped of their paraphrasing, Mr. Marshall's questions are as follows:

1. If glare is so injurious to the eyes as is generally represented, why is it that those whose work subjects their eyes to the most intense glare, such as glass blowers and those working with molten or white hot metals, operatives in electric lamp factories, etc., do not suffer severely from the effects?

2. Is indirect lighting a good or bad method of illumination?

3. Is the light of the Cooper Hewitt Lamp injurious to the eyes?

Undoubtedly there is need of more careful investigation on all of these points before a positive answer can be given. This is a line of investigation which the new Association for the Conservation of Vision may very properly, and doubtless will, take up. Being a strictly professional body, as carefully guarded against commercialism as the profession of medicine itself, the association is in a position to approach these subjects from an impartial standpoint, and to hear all evidence on its merits and render a just and true verdict. Until such results have been obtained, however, observations on these questions may not be out of place.

As to the effect upon the eyes of constant subjection to intensely brilliant luminous sources, the first observation that suggests itself, at least in the case of those handling molten glass and metals, is that decidedly injurious effects do frequently follow, cataract being a common result. This is a matter which has received serious attention, and the use of glasses to cut down the injurious rays is urged as a remedy.

In regard to the operations in the making of incandescent electric lamps and mantles, in which the filament material is observed at a state of high incandescence, the apparent immunity from trouble is probably due to a considerable extent to individual adaptability; the eyes vary in strength in individuals, quite as much as does the muscular or bony structure, and only those with eyes sufficiently strong to withstand the strain remain at the work.

As a matter of fact there is severe eye-strain from such causes, but the workers endure it for the sake of their wage, as in scores of other dangerous or harmful occupations.

As to the effects of indirect lighting, the opinion is practically unanimous of those who have used it for clerical work, or for general illumination where close vision is not required, that it is the most restful and comfortable to the eyes of any form of artificial illumination; and from such a verdict there is absolutely no appeal. No matter what the scientists may say, whether they be physicians, ophthalmologists, or illuminating engineers, the observed results of a given form of illumination upon a sufficiently large number of persons, and for a sufficient length of time, determines the fitness or unfitness of such illumination beyond all doubt or peradventure. The one thing essential in order to arrive at conclusive results is a sufficiently wide range of observations, both in number of individuals and in length of time.

The ultimate effect upon the eyes of light of such unusual color quality as that of the Cooper Hewitt Lamp must be determined by this process. Thus far there is no sufficient evidence of any injurious results.

Theories are interesting, and when rightly considered are a valuable tool in the hands of the scientist; but it must be constantly borne in mind that they are merely suppositions, and that the most plausible theory ever formulated cannot stand for a moment against a single authentic fact.

Glare and Visual Aguity

The general subject of "glare" has been the storm center of investigation and discussion among illuminating engineers throughout the world during the past year. The British Illuminating Engineering Society gave one evening to the subject, and there have been various papers relating to it presented in this country since. In the recent researches the attempt has been made to measure the effect of glare in terms of visual acuity. In a paper before the New York Section of the Illuminating Engineering Society, Mr. A. J. Sweet reported that the results of such investigation showed that visual acuity was not interfered with by light-sources more than 25 degrees from the direct line of vision, and, as noted elsewhere in this issue, has stated that "glare" in this sense of the word is determined by the total flux of light entering the eye rather than the intrinsic brilliancy of the source.

While these results are interesting, the mistake must not be made of giving too much weight to mere acuity of vision; in fact, this is of comparatively little importance. The one effect which far outweighs all other considerations is eye-strain, and it requires no scientific apparatus nor measurements to demonstrate that a light of high intensity is enormously more irritating to the eyes than the same amount of light of low intrinsic brilliancy. The time element is also a factor which must be distinctly taken into account. There are plenty of cases on record where sight has been absolutely destroyed by continual exposure to the bare filament of an incandescent lamp; and it is a matter of the commonest observation that even an hour spent in an auditorium where no acuity of vision whatever is required, but where there are intense sources even far more than 25 degrees from the direct line of vision, can produce such severe eye-strain as to result in headache and other distressing symptoms.

No more mischievous theory could be promulgated than this of the measurement of glare by visual acuity. While it would be understood by the few scientists who are accustomed to analyze statements and take them in their strict scientific sense, it would be generally mistaken by the layman. Evidently the meaning of the word "glare" needs a decided clearing up, and a definition arrived at which will not mislead the general public.

Letters

EDITOR ILLUMINATING ENGINEER,
New York:

We have read with reverence an article entitled "A Misstatement of Fact," by H. B. Wheeler, on pages 21 and 22 of the March, 1911, issue of THE ILLUMINATING ENGINEER. Beneath this Rooseveltian title appears a charming literary tribute to

the manufacturers' representatives' art of self-adulation.

The statement which apparently prostrates our commercial critic — "In a large ballroom in the West, equipped with this system, it is absolutely impossible to recognize the features of a person standing at a distance of 50 ft"—we must admit, with profound regret, did not originate with us, but emanated from one of the foremost, independent (not on the payroll of any manufacturing concern) authorities on illuminating engineering in this country — the gentleman in question making the above statement at a lecture given during the special course of lectures on illuminating engineering presented by the Illuminating Engineering Society, under the auspices of Johns Hopkins University at Baltimore. This statement was made by the noted authority after a most careful analysis of indirect lighting systems in general, and the one alluded to in particular. As the researches and investigations of the writers heartily concurred in the verifications of such statement—substantiated by their personal observations of the installation in question—it was used.

While it is true the pages of the technical journals, in part, serve the admirable purpose of a clearing house for promiscuous data relative to the art of illumination, when we consider the sublime heights of engineering intelligence to which commercialism has aspired in recent years — expression fails us — and with bated breath we stand aghast in reverent awe! Respectfully,

Francisco Laurent Godinez,
Albert Jackson Marshall.

Editor, The Illuminating Engineer,
New York, N. Y.

Dear Sir: I noted, in your last issue, my paper read at the Byllesby Convention, Chicago, and I wish to call your attention to a slight error in same, should there be any controversy regarding it.

You mentioned the Chariot Race sign being under discussion at a meeting of one of the New York engineering societies and a comparison made between their discussion and my paper. Lest there should be any misunderstanding, I wish to advise that all my deductions were based on the installation and operation of the first Chariot Race sign erected, which was in Dayton, Ohio. The second being Detroit, and third, New York, and as the original estimates of operation, etc., on the Dayton sign would not apply to the other two, my article may be misunderstood as covering the others.

All facts and figures quoted, however, are strictly accurate as to the Dayton installation.

Yours very truly,
A. Larney,
Manager New Business Department,
Oklahoma Gas & Electric Company,
Oklahoma City.

Notes and Comments

Decorative Street Lighting Movement Strikes the East

Like the weather, the discovery of the advantages of decorative street lighting originated on the Pacific Coast and has steadily advanced eastward. While there have been occasional local squalls in the East, the storm center of the movement has remained in the West until very recently. The latest reports, however, now indicate that it has reached the Eastern belt, and is particularly active in New York State.

Reports of new installations, or agitation for such, have been so numerous within the past month that we can only report them briefly, with such comments as have been made by the local daily press:

"Fellow merchants, let us get after this matter in earnest and make 'Binghamton the city of lights.' We want a light in front of every store on our main business streets, because business follows the lights; everything gravitates toward the light. First, let there be light; then greater commercial activity will follow."—*From speech of a leading merchant at meeting above referred to.*

BINGHAMTON, N. Y.—Boulevard lights for the central portion of the city would vastly improve the streets on which business is largely concentrated.

When the gas and electric signs which are

maintained by the individual enterprise of the merchants are dimmed after midnight, even Court street is as dark as the proverbial pocket. The lights which the city pays for serve only to "make the darkness visible."

Boulevard lights, like the gas arcs at Chenango and Henry streets and in front of the Stone Opera House, or like the electric clusters on the Court Street Bridge, would be a vast improvement over the overhead arc lights which illuminate a small patch at the street corners.

By installing the boulevard system of lighting on Court street between the bridge and Carroll streets, and on Wall, Water, Washington, State and Exchange streets, within a block or two of Court, and on Chenango to the viaduct, the business district would be greatly developed.

The Merchants' and Advertisers' Association last night appointed a strong committee to consider the question, to ensemble information and make recommendations. The report will be awaited with great interest.—*The Press.*

BOROUGH OF BROOKLYN, N. Y.—The stirring slogan "Boost Brooklyn" is daily enlisting the interest of prominent manufacturers and business men eager to advance the prestige of the borough. The latest of all the late devices to attract attention to the advantage of Brooklyn is that of the Brooklyn Edison Company. They have designed a real "Boost Brooklyn" electric lamp-post. The post consists of a bronze pillar, 14 ft. in height. Pendant from the top are four 12-in. electric globes. At the summit, and upright, is a model 16-in. globe.

Broadway, Brooklyn, has taken to the scheme with avidity, and it is promised by the merchants along that thoroughfare that their lighting system will soon rival that of the "Great White Way" in Manhattan. Several of the prominent business concerns in downtown Brooklyn have already installed decorative lights of one kind and another.—*Brooklyn Eagle.*

AUBURN, N. Y.—In a communication to the Council, Mayor O'Neill called attention to the hearing before the Common Council to-morrow evening on the matter of an inside lighting district for the city, to cover the business section. The directors discussed the matter at some length. All favored the idea of an inside lighting district, but there was a difference of opinion as to whether the cost of ornamental lights should be borne by the property in the immediate district or by a tax on the whole of the city.—*Syracuse Post-Standard.*

BALDWINSVILLE, N. Y.—After considering a number of new plans of standard construction of a permanent form of illumination there has been prepared and tried satisfactorily by several places a plan of installation of arched strings of lamps on the principal streets.

The object sought is to increase efficiency of the lighting, preserve the harmonious effect, the gala appearance and reduce the lamp maintenance cost; also the consumption of current.

Each one of the arches is equipped with ten 32 candle-power series tungsten incandescent lamps, giving a total of 320 candle-power per arch, as against 200 candle-power in one of the present streamers. Each one of these lamps will be equipped with a special ornamental reflector to give even illumination over a large area and reflect all of the light which otherwise would be lost.—*Gazette.*

WATERTOWN, N. Y.—A paid "ad." of the lighting company appeared in the *Times'* columns yesterday, urging business men to put up electric signs, making a blaze of light in the business center and so making it attractive at night, not only to the people of the city, but the country round about, and advertising it as a live town. We are inclined to supplement this paid-for advertisement with a little free advertising to stimulate the project, which the *Times* has frequently advocated. The experiences of "Firemen's week" showed how the illuminated square was appreciated by the people, making it a social center on the pleasant evenings. It was a large advertisement for the town to outsiders and proved to be the principal and most attractive feature of that celebration. Everybody asked, "Why cannot this be continued?" The reason was that the city did not have the money to continue it, though all acknowledged its advantage. It has been encouraging to note a slow growth of electric signs to help in the illumination of the square and it should be encouraged. In Rochester they have made Main street, their principal shopping street, blaze like the "Great White Way," of Broadway. This, aside from the regular street lights, which the city has added in profusion, is done by the business men in the form of electric signs. They are satisfied that it pays. It not only brings out a larger trade from the city itself, but attracts from a wide belt of surrounding territory. It fills the shopping district with people at night, and if stores are not open for business, it at least causes a closer inspection of the displays in the store windows and helps to-morrow's trade. It is a most attractive advertising feature, not only advertising each individual merchant, but the city as a whole.—*Editorial, Watertown Times.*

WASHINGTON, D. C.—It is gratifying to note the District Commissioners are heeding the appeal of citizens for better lighted streets. During the past week the columns of the Washington *Herald* have been filled with the protests of citizens' associations and of individuals against present conditions, and it must be admitted that there is some ground for complaint. The streets of Washington are, as a general rule, dark and unattractive. Even the principal thoroughfares, with the exception, perhaps, of Sixteenth street, are poorly lighted, and Pennsylvania avenue, which ought to be a blaze of glory between the Treasury and the

Capitol, is only saved by the electric signs from resembling a country lane.

Some physical reasons beyond the control of the authorities are, in some measure, responsible for this state of affairs in Washington. The streets are unusually wide, and the trees which line the thoroughfares seriously interfere with illumination. It is also true that the appropriations have never been as generous as the estimates of the commissioners. Notwithstanding these facts, it would seem to be possible for the experts of the street lighting department to devise some means whereby a better result could be obtained for the money expended. If the commissioners, as is evident, fully appreciate the situation, and are laboring to remedy conditions, we may expect a marked improvement in the near future. It is certain that if all the modern lighting appliances which are now at the service of municipal authorities be made available, the National Capital will not be compelled to occupy a second-rate position among the cities of the country. Its dark streets will be relegated to the past, just as mud and cobblestones and horse cars are matters of memory.

The better illumination of the city cannot come too soon.—*Editorial, Washington Herald.*

PITTSBURG, PA.—Public Works Director Armstrong is considering the improvement of the lighting system throughout the downtown district. The installation of new arc lamps in Liberty avenue by the Allegheny County Light Company has proven so successful that similar lights may be placed in Fifth avenue, between Grant street and Liberty avenue, in Smithfield, Wood and Water streets.

It would cost $6000 a year more than the present cost of maintenance to make the change, but there would be an increase of ninety-four arc lamps, and the quality of lighting would be much superior. Liberty avenue is now by far the best-lighted thoroughfare in the city, with the possible exception of Penn avenue, East Liberty. Director Armstrong is in favor of accepting the light company's offer to install a new system in the streets mentioned, and the idea will probably be carried out if the money can be provided.—*Post.*

Arc lights are to be placed on both sides of the walk leading to the Soldiers' Memorial Hall. Recent accidents, the result of stumbling on dark nights, caused this action which was decided on at the annual meeting yesterday afternoon of the Allegheny County Grand Army Association in the hall.—*Gazette-Times.*

HARRISBURG, PA.—Harrisburg merchants are following the example of the business men in Philadelphia who brought about better illumination, and a number of high lamps will be erected in Market Square and on Second street, and the vicinity of Walnut.—*Philadelphia Press.*

COLUMBUS, OHIO.—Tentative estimates and plans for the supplanting of the arch system of lighting High street by the cluster system have been made by Director Holton and members of the City Council.

Unless strong opposition to the plan develops, it is practically assured that the City Council will consider the proposition of installing the more modern system.

A large number of designs for cluster lights have been received by the director of service, who, with the superintendent of the municipal light plant, is now estimating the cost of installation and maintenance. Both Director Holton and Superintendent Gampers favor the new proposed system.

They explain their approval of the clusters rather than the arches on the opinion that the clusters will not only prove far more ornamental both by day and by night, but will give many times as much illumination along High street. "When it comes to a comparison of the two systems," said Gampers, "it is not a matter of lights, but of illumination."—*News.*

It must not be inferred from the activity of the movement in the East that it has ceased to attract attention in the West, as the following items will show:

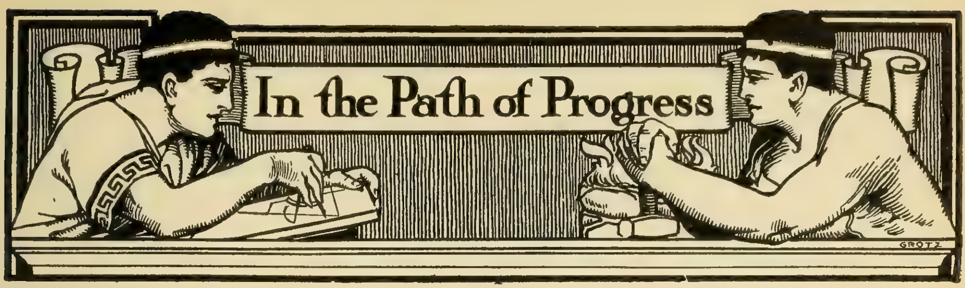
SAN DIEGO, CAL.—Ordinances were passed by the Council yesterday morning providing for the installation and maintenance of twenty-one new street lights of the low-arm type. The question of additional street illumination for some sections of the city has been considered for a long time, but it was only recently that the lighting fund was large enough to sustain the expense of more lights.—*Union.*

ESCONDIDO, CAL.—President W. H. Baldridge and City Clerk Henry Nulton have been authorized by the City Trustees to enter into a contract with the Escondido Utilities Company for the lighting of the city streets by electricity for the next five years.

The matter of cluster lights along Grand avenue has been taken up by some of the business men, with good prospects of a number being installed. The additional lamps will be of the tungsten pattern, 80 candlepower.

The fact that the city has electric light and gas has been a big drawing card and the announcement of the entering into a contract that will increase the lighting facilities is received with pleasure.—*San Diego Tribune.*

WATERLOO, IOWA.—The first boulevard light, except the two in front of the city hall, to be installed in the city was placed in front of the Marsh-Place Building, corner of Fifth and Sycamore streets, this morning, on the Fifth street side. Others are to follow in this block and then they will be put in from the bridge to Lafayette street on Fifth street.—*Courier.*



General Progress During the Past Year

(Continued)

To supplement the letters reviewing the progress of the past year, published in the March issue, we are including herewith several that were received too late for publication.

From N. L. Norris, President and General Manager, The Banner Electric Company, Youngstown, Ohio:

In my opinion the last twelve months have shown by far greater advancements along lines of improved illumination—not only as to methods employed, but as to types of units—than has any like period in the past. By types of units I refer not only to the lamp itself, but to reflectors as well.

The improvement in incandescent electric lamps within the past year has been greater than in any similar period in the past—not only as to new types of lamps, but as to the quality of all types.

These improvements are, no doubt, due to a very great extent to the sharp competition which exists between the various manufacturers in the matter of quality; competition which encourages the most constant and thorough research work for the improvement of quality.

The science of illuminating engineering has within the past year become firmly established and fully recognized as an important feature in existing and future installations. Expert information on this all important subject is now readily available and the old time, haphazard installations are fast becoming the exception instead of the rule.

For the future the outlook is exceedingly bright, and with the proper units at hand and correct information for their installation available, the public are in a position to enjoy the benefits which the advancements of the past have made possible.

From Clare N. Stannard, Secretary and Commercial Manager, The Denver Gas & Electric Company, Denver, Colo.:

The Denver Gas & Electric Company under the leadership of its president, Mr. Henry L. Doherty, has during the past year made considerable progress in its street, business and residence lighting. Many arcs have been added to our street lighting circuits. In the business district we have installed a large number of signs and done a great deal of window lighting and outlining work. During the past year we have been unusually successful in installing animated and flashing signs. We have also installed a large number of high candle-power tungsten lamps fitted up with Holophane reflectors on the exterior of stores and business places, thus brilliantly illuminating not only the front of the store but the street in the vicinity. Our merchants in a number of instances have clubbed together and jointly borne the expense of illuminating the entire block in this manner. The tungsten lamp, through expert advice on the part of our representatives and Illuminating Engineering Department, has in the business portion of the city been the means of our securing a greatly increased revenue. It

has also increased the standard of illumination which results in their securing three or more times the light heretofore received, giving the company the same or a slightly increased revenue; thus what was at first thought to be a menace to our revenue for this class of business has resulted in an increased revenue.

We are now interesting many of our merchants in brilliantly illuminating their stores from closing time (which in most instances is 6 o'clock) until midnight. Some of the merchants feel that this new form of electric advertising is of more value to them than exterior signs.

We have in Denver three "White Ways," namely, Fifteenth, Sixteenth and Seventeenth streets. We are adding another in one of the suburban parts of the city. Poles are now being erected and current will be turned on in the near future. Local and suburban societies have similar projects under way, so we expect in the near future that this form of lighting will be very popular not only in the center of the city but in all our suburbs as well.

We consider our Sign Department and our Illuminating Engineering Department two very important departments in connection with our work of securing more and better exterior and interior lighting.

The city has an Art Commission that has the general supervision of all exterior lighting, and we find that by maintaining the two departments as above mentioned we work in perfect harmony with the Art Commission, and that we are enabled to secure results which we might not otherwise be able to secure.

We heartily recommend operating companies in cities the size of Denver maintaining similar departments.

From Warren Partridge, General Superintendent, Springfield Light, Heat and Power Company, Springfield, Ill.:

Regarding the lighting situation in Springfield, I might mention a rather unusual installation of ornamental posts in Springfield, Ill., consisting of 95 3-light posts and 45 5-light posts, a total of 139 posts covering a continuous stretch of boulevard—approximately three miles in length.

The posts are equipped with 60-watt lamps on top, which burn all night, and 40-watt side lamps, which are turned off at midnight.

The installation is quite effective, as from nearly any point on the boulevard the lamps can be observed stretching out for over a mile in either direction.

The 5-light posts are located in the business district with four at each street intersection and additional lamps at intermediate points in the blocks. The 3-light posts cover the residential sections, with two lights at each street intersection and the intermediate lamps.

From W. A. Brackenridge, Vice-President and General Manager, Southern California Edison Company, Los Angeles, Cal.:

As Los Angeles (save for a small portion of the old city) has been built since the era of electricity, practically every building is wired for lighting. It thus follows that the increase in illumination during the past year has resulted from the increase of installations in houses that are already wired rather than from superseding gas, from the greater use of tungsten lamps, and from the fact that our people are becoming educated to liberal illumination and now burn many lamps where formerly one or two sufficed.

Lighting of stores and theaters has been greatly increased by the work of our illuminating engineers and electric advertising specialists. By various forms of advertising we have kept our patrons informed that the free services of these experts are always at their disposal.

The existence of drastic ordinances restricting the projection of signs over sidewalks to 30 in. and the height of roof signs to 20 ft. above fire walls has greatly limited the installation of these devices. As a consequence, merchants are reluctant to invest in costly electric devices, and we have accordingly put forth our efforts with considerable success in the direction of mechanical effects and greater window illumination. The outlining of hotels, theaters and other buildings by incandescent

lamps is one of the features of our present campaign. This is an effective form of advertising and we look forward to a greater increase in its use.

Our persistent efforts in the direction of increasing the illumination of window displays has met with most gratifying results. The efficiency of the tungsten and other lamps is becoming well understood by our merchants through the constant work of our solicitors, and in the shopping district the result of this work is most manifest. There seems to be a general tendency to increase window illumination in every possible way, and we are finding it a very profitable line of promotion which is resulting in the consumption of a larger amount of current by our merchant customers.

Municipalities, and in some instances private lighting districts, are making large expenditures for ornamental street posts and cluster lamps. The installation of the new magnetite lamps is greatly appreciated by the people of the cities and towns in which we have thus far placed them, and the improvement over the old arc lamp has resulted in gratifying commendations from the press.

From A. Cressy Morrison, Secretary-Treasurer, International Acetylene Association, Chicago.

I wish to congratulate you upon the attainment of your fifth anniversary, and desire to speak with enthusiasm regarding the constant optimistic uplift which you are giving illuminating engineering.

Permit me to thank you, also, for the liberal share of your space which you have accorded the acetylene industry. You will be pleased to know that acetylene is advancing in a remarkable manner. I presume that not less than fifty thousand acetylene generators have been installed in rural homes during the past year. The United States Government is using acetylene with remarkable effectiveness for beacon lights and buoys. The introduction of acetylene as a means of illumination in mines is rapidly extending. The use of acetylene for contractor's lights, where large units are required, is generally acknowledged to be extremely effective. The remarkably extended use of acetylene for automobiles, this field being quite as large as the automobile industry, continues. The progress in town lighting with acetylene is extending slowly but surely, and this brilliant illumination is now generally recognized as probably the most acceptable for locomotive headlights. Car lighting by acetylene is steadily advancing and the field for acetylene is extending in a positive multitude of minor directions, all of which mark the advance of a great, progressive and rapidly growing industry.

Autogenous welding—that is, the use of acetylene in connection with oxygen through a blowpipe for metal working, *i.e.,* welding and cutting—is extending so rapidly that it will revolutionize many industries. While this does not touch the field of illumination, it is too important to omit in mentioning the progress of the industry.

The conditions which I have described above relate particularly to the United States, but there is little difference in the progress throughout the world. The advance of acetylene as an illuminant in tropical and semi-tropical countries is extremely rapid, and this is resulting in an export business from all the carbide producing countries to the most remote outposts of civilization.

We are proud, indeed, of the progress of the acetylene industry, which is really based upon a thorough appreciation of the necessity of manufacturing perfect mechanism for its generation and utilization, and we are glad to have found in the columns of your esteemed publication such recognition as you have so generously accorded us.

From Manfred A. Pakas, Sales Manager, Lamp Standard Department, Flour City Ornamental Iron Works, Minneapolis, Minn.:

For the past few months we have particularly noticed The Illuminating Engineer. We must, in justice to yourselves, tell you that your magazine has won a recognized place for itself in the illuminating field.

The character and tenor of the editorials deserve special mention. They are

not only interesting but instructive and practical.

The entire subject of "Municipal Illumination" has assumed gigantic proportions. Every little village and hamlet, as well as the small, large and great cities, have recognized the true importance of "Ornamental Street Lighting."

Communities now realize that their city is judged greatly by the kind of street lighting they use. The nocturnal appearance of a city's streets reveals in a most pronounced manner the enterprise and character of its inhabitants. The most casual observer is thereby forced to notice the indication of advance.

In keeping with the general advance the Flour City Ornamental Iron Works Company have last year produced a new and distinct type of Standard, the "Boulevard Standard." Just as the name suggests, the "Boulevard Standard" is the ideal post for the illumination of public squares, parks and boulevards. It is a marvel of simplicity. The graceful lines, the solid castings, produce that impressive, stately effect, so noticeable in the "Corinthian Standard."

The other noteworthy features of the year are the new "Inverted Corinthian" and the "Inverted Egyptians." These Standards are the inverted supplements of the five-light "Corinthian," and the five and three-light "Egyptian Standards," respectively.

The new year has started out with a rush. All we can say in reference to the outlook is that as the country becomes more enlightened and realizes the advertising value and actual necessity of proper modern street illumination, the inevitable result is bound to be a greater and a more pressing demand for recognized standards.

Let us extend our hearty congratulations for the success of your worthy magazine.

The Morris Iron Company to Have a New Modern Plant

The Morris Iron Co., successors to Elmer P. Morris Co., Frederick Iron Works, and Montrose Iron Works, are reconstructing their plant for the production of ornamental street lamp posts and exterior lighting appliances, located at Frederick, Md. The new works will consist of seven buildings with a total floor area of some two and one-half acres, and will be equipped with new modern machinery and appliances throughout, including a generating plant for electric lighting. When completed the company will give employment to between two hundred and fifty and three hundred men continuously. The sales office will remain at 92 West street, New York City; but the general offices will be installed in a special building at the works.

The Straight Filament Lamp

At a recent convention a representative of one of the largest lamp makers stated that there were over 100,000 different kinds of incandescent electric lamps regularly catalogued. One would imagine that this number would include all conceivable forms, but to paraphrase a very old saying, "Of making many lamps there is no end," and among all these 100,000 there was not one which had a filament in a *continuous* straight line. A lamp of this description is now being successfully manufactured and sold by the Electric Specialties Company, of New York City. The lamp consists of a glass tube seven-eighths of an inch in diameter and ten inches long, through the centre of which passes a single straight carbon filament, which is attached to the leading-in wires at opposite ends of the tube. The method of forming these leading-in wires gives such a degree of tension upon the filament that it is held constantly straight whether cold or incandescent.

Announcement

The Congress of Technology, which is to be held in celebration of the semi-centennial of the Massachusetts Institute of Technology, Boston, Mass., on April 10, 11, presents a program of papers and addresses, which will constitute a fitting tribute to the exceptionally high standard that this institution has always maintained in technical education. Among the papers will be one on "Improvements in Efficiency of Electric Lighting Properties, and What the Public Gains Through These Improvements," by Mr. William H. Blood, Jr., technical expert with Stone & Webster, Boston.

Proceedings of Technical Societies

The Illuminating Engineering Society

The New York Section held its monthly meeting in the auditorium of the new store of Gimbel Bros., New York City, on the evening of March 9. The illumination of the store was described in a paper by Clarence L. Law and Albert J. Marshall. Previous to the presentation of the paper the members and guests were shown through the store, and the various problems in illuminating engineering and the manner of their solution explained.

The Chicago Section held its monthly meeting on the evening of March 16. Mr. J. R. Cravath presented a detailed paper on the lighting of a small room, the room in question being a living room 16½ ft. long, 12 ft. wide, and 8½ ft. high. The illumination in all cases was produced by a single 160-watt tungsten lamp, giving 773 lumens, placed in the center of the ceiling.

A full discussion of the paper followed.

The New England Section held its meeting on the evening of March, at which Messrs. E. P. Hyde, F. E. Cady and A. G. Worthing presented a paper on the "Investigation of the Energy Losses in Incandescent Lamp Filaments." According to their observations the various types of lamps lose in efficiency by reason of heat conducted away at the terminals, the following amounts when running at ordinary voltages: Carbon, 4 per cent.; tantalum, 13 per cent.; tungsten, 7 per cent.

The inaugural address of the President, Prof. A. E. Kennelly, is given in the February proceedings. Professor Kennelly took for his subject "The Profession of Illuminating Engineering," and his address, though comparatively short, is the clearest exposition of the subject that has yet appeared. It is difficult to abstract from a paper so concisely written, but the following paragraphs are especially notable.

"I take it that this Society stands for the proposition that a competent, trained illuminating engineer can light a street, dock, office, factory, art gallery, theatre, or home very much better than the untrained, haphazard man. Not only this, but he will also demonstrate arithmetically wherein it is better that there is by design ample light where it is wanted and little or none wasted where it is not wanted, that there is no needless glare, that the cost of the lighting is moderate and in harmony with the cost of the structures in other respects. Above all, he will be able, for this expenditure, to produce a much more graceful and pleasing illumination in tones, intensities, colors, shadows and harmonies than the haphazard man.

"The mistake is but too often made, that if the illuminating engineer provides the requisite distribution of light at a low cost, his duties are sufficiently discharged without any reference to the esthetic quality of his work. This performance would, however, be as defective as installing a graceful and pleasing set of light-sources, but without any regard to whether the illumination was adequate or excessive. It is in the absolute necessity of observing the rules of esthetic taste that the work of the illuminating engineer differs most markedly from the work of other classes of engineers.

"The conscientious illuminating engineer is ordinarily called upon to be self-effacing and undemonstrative in the results of his work. It may be asserted, as a general rule, that any artificial lighting is esthetically bad, which forces itself upon the undirected attention of the observer. Good lighting is harmonious and satisfying, but unobtrusive. If an observer enters a building, with its lighting in his mind as the thing to be examined, then the criterion cannot be set up; but if, with his mind open, the first thing that forces itself upon his notice is the illumination, then that illumination cannot be esthetic."

American Institute of Electrical Engineers

At a meeting of the Seattle Section, held on November 19, 1910, a paper on Photometry of Seattle's Street Illumination was presented by Raymond A. Hopkins and Earl J. Beery. Tests were made with a Sharp-Millar photometer on five ball cluster systems, using both tungsten and G E M lamps, and also on inclosed arc and series tungsten lamps. Results of the measurements are given in the form of curves.

New England Association of Gas Engineers at Boston, Feb. 16-17.

At the last meeting of this association a paper on Gas Arc Street Lighting was presented by Mr. H. H. Kelley. The paper describes what the author believes the first "Gas White Way" installation in Massachusetts. This is in Waltham. Wrought iron posts are used, each supporting two gas arcs. The posts cost, complete, ready to install, $48, and the average cost of maintenance during the winter has been only 38 cents per month per post. The property owners pay $6 per month per post on a yearly contract, the lamps being lighted every week day from dark until 11 p.m.

Minnesota Electrical Association

At the Fourth Annual Convention of the Minnesota Electrical Association held in St. Paul, March 14, Mr. Ludwig Kemper presented a paper on "Curb Lighting." After treating the commercial side of the question from the central station viewpoint, Mr. Kemper discussed the illuminating engineering phase of the subject, expressing the opinion that the decorative feature is quite as important as mere illumination. He deprecated the use of complex reflectors on the ground that even though they might increase the illumination on the pavement two or three times, the expense of keeping them cleaned and the loss of efficiency if they were not kept in such condition would more than over-balance this gain. The globes themselves are the essential feature of the installation and should have an attractive and brilliant appearance, and if too much light is thrown in the direction of the neighboring show windows it will reduce the effectiveness of their own lighting.

A paper on "Residence Lighting" was presented by Mr. C. E. Van Bergen. After reciting some interesting statistics on residence service in Duluth the writer set forth the commercial value of residence lighting when properly handled, and urged the necessity of keeping the subject of proper lighting constantly before architects and owners.

Mr. Henry Schroeder presented a paper on "Incandescent Lamp Improvements," in which he traced briefly the history of the incandescent lamp from the carbon filament to the most modern types. The astonishing statement was made that there are more than 100,000 different kinds of incandescent lamps regularly turned out by the manufacturers.

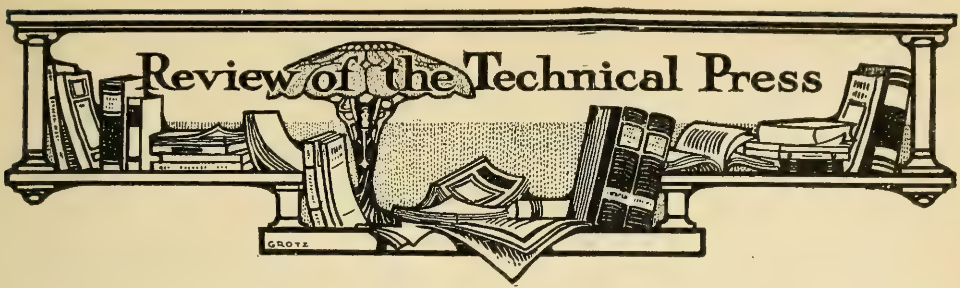
"Show Case, Display Window, Outline and Sign Lighting" were discussed by Mr. T. R. Wilwerschied, the argument being chiefly to demonstrate the value of this field of lighting to the central station.

Car Lighting Club

At the meeting of the Car Lighting Club, Chicago, held March 15, the subject of "Glare Resulting from Light-Sources Within the Field of Vision" was given general discussion. Mr. A. J. Sweet referred to his researches on this subject, by which he determined that a light-source more than 25 degrees from the direct line of vision did not decrease visual acuity. He also stated that results obtained both by himself and other investigators showed that the amount of glare is not due to the intrinsic brilliancy, but to the total light flux. Thus, an electric lamp in an opal globe would give the same glare if placed in the line of vision as if the lamp were used bare. By "glare" he evidently means the effect on the acuity of vision.

Michigan State Society of Stationary Engineers

At a meeting of the Kalamazoo branch of this association, held February 25, Mr. W. J. Trott gave an address on "Electric Lamps in Industrial Illumination," illustrating his remarks with stereopticon views.



American Items

Federal Suit Against Incandescent Lamp Companies; *Electrical World,* March 9.

A lengthy discussion covering the details of the bill of suit brought by the Government against the associated incandescent lamp interests.

Downward Light Versus Eye Strain; *Electrical World,* March 9.

An interesting and useful discussion of the relative values of vertical and horizontal intensities in general illumination, particularly as applied to auditoriums. The writer brings out the fact that, while illumination from a number of light-sources on the ceiling so equipped as to give a large preponderance of vertical rays may be perfectly satisfactory for reading or the observation of objects in a horizontal plane, it is wholly unsatisfactory for objects in the vertical plane, as the faces of persons. Indirect illumination is criticized as having, to a certain extent, this fault, although it is admitted to be entirely satisfactory, so far as the comfort of the eyes is concerned. The writer concludes that where walls and floors are dark the illuminating engineer must choose between the evil of eye discomfort and the evil of insufficient vertical illumination to fully illuminate faces.

The Flame Arc Holds the Trade, by H. Thurston Owens; *Electrical Review and Western Electrician,* February 25.

A short illustrated article on the value of the flaming arc for attracting business.

Simple Method of Determining Luminous Flux From Polar Curves, by W. E. Barrows, Jr.; *Electrical Review and Western Electrician,* March 4.

Mr. Barrows demonstrates a graphic method of determining the flux of light, either in the entire sphere or any portion thereof, which he claims, and with apparently sufficient reason, is the simplest method yet devised for making these computations. The only apparatus necessary is a pencil and piece of paper, and the only calculation is simple addition of from 9 to 18 values.

Lighting of a Breakfast Food Factory, by Roscoe Scott; *Electrical Review and Western Electrician,* March 11.

A short illustrated article on the lighting of the factory of the Kellogg Toasted Corn Flake Company of Battle Creek.

Increasing Use of Dimmers; *Electrical Review and Western Electrician,* March 18.

A short illustrated article on the use of dimming equipment for controlling the illumination of theatres, halls, churches and large auditoriums.

Notes on Factory Lighting, by C. E. Clewell; *The Electric Journal,* March.

A lengthy illustrated article comparing old methods and units for factory illumination, such as the inclosed carbon arc and the carbon filament incandescent lamps, with such newer types as the tungsten, the Cooper Hewitt and the Nernst lamps.

Mr. Clewell concludes:

"The first consideration in factory lighting, if properly appreciated as an invaluable accompaniment to the quality and quantity of the work performed in a given time, is the usefulness of the light rather than the placing of too much emphasis on cost values, which are often misleading. If the factory manager can gain something of this attitude to the lighting question, viewing the matter as an asset to factory production and will study the kind and quality of light most suitable to each condition of work, better results may be expected than when all attention is fixed on slight differences in first cost or annual charges."

THE AMBER LIGHT CAMPAIGN IN CHICAGO, by T. R. Beebe; *American Gas Light Journal,* March 13.

A short article on the recent campaign of the People's Gas Light & Coke Company, Chicago, in introducing the new amber light mantle.

LIGHTING WORK WITHOUT SHADOWS, by James R. Cravath; *Factory,* March.

A short illustrated article on factory illumination.

ILLUMINATION FOR UNCOMPLETED BUILDINGS, by J. A. Walton; *Selling Electricity,* March.

STORE LIGHTING IN CLEVELAND'S DOWNTOWN LIGHTING DISTRICT, by Roscoe Scott; *Selling Electricity,* March.

COLOR OF LIGHT FROM INCANDESCENT MANTLES, by Norman Macbeth; *National Commercial Gas Association's Monthly Bulletin,* March.

A NEW DEPARTURE IN REFLECTORS FOR APARTMENT LIGHTING, by Roscoe Scott; *Building Management,* March.

INCREASING LABOR EFFICIENCY THROUGH SCIENTIFIC ILLUMINATION; *American Industries,* March.

ORNAMENTAL STREET LIGHTING AT CINCINNATI, O., by an Editorial Correspondent; *Municipal Engineering,* March.

A full description of the trial street lighting installation recently installed on Race street. The installation consists of ornamental lamp posts equipped with tungsten lamps and a combination prismatic and opal reflector. This is the first practical trial of this new device, which is stated to give a considerably higher intensity of illumination on the pavement than the plain opal or sand-blasted balls frequently used.

MEASUREMENTS OF THE RATE OF DECAY BY GAS PHOSPHORESCENCE, by C. C. Trowbridge; *Physical Review,* February.

NOTE ON CROVA'S METHOD OF HETERCHROMATIC PHOTOMETRY, by H. E. Ives; *Physical Review,* March.

LIGHTS' INTENSITY, POWER AND VOLUME, by George A. Rogers; *Optical Journal and Review,* March 2.

This is a continuation of the above serial and covers the subject of "Atmospheric Obstructions."

STORE WINDOW LIGHTING; *Dry Goods Reporter,* March 18.

ILLUMINATION, COMPARISON OF VARIOUS LIGHT-SOURCES; *Data,* March, 1911.

Editorials

Electrical World:

THE FEDERAL LAMP SUIT, March 9.

ENERGY LOSSES IN INCANDESCENT LAMP FILAMENTS, March 9.

Electrical Review and Western Electrician:

FIRE HAZARD OF ELECTRIC SIGNS, February 25.

TRADE FOLLOWS THE LIGHT, February 25.

THE USEFULNESS AND FUNCTIONS OF THE ILLUMINATING ENGINEERING SOCIETY, February 25.

SPECIAL INCANDESCENT LIGHTING FOR BATTLESHIPS, March 18.

American Gas Light Journal:

THE ADVANTAGE OF LARGE OVER SMALL LIGHTING UNITS, February 27.

STREET LIGHTING, February 27.

ARCHITECTURAL LIGHTING; *The American Architect,* March 8.

"The possibilities that lie in correct illumination as an aid or adjunct in the architectural treatment of interiors are apparently just beginning to be fully realized. Perhaps this is due to the comparative newness of the illuminant that has come into almost universal use within a few years. Its advent has given rise to a pursuit or profession practically unknown when the torch, the oil lamp or even the gas flame, was depended upon for illumination. The calling of the illuminating engineer is now one of acknowledged and growing importance. Architects are learning to call to their assistance men technically trained in the science of illumination, as they have for many years called sanitary engineers, heating and ventilating engineers and other specialists in the various departments who, taken together, constitute the working force of a well organized office, equipped to handle the complex problems arising in the construction of a modern building. It is not surprising that some time has been consumed in learning to adapt and make the most of this new agent. The engineer beginning his work knew little of architecture or its requirements, and few architects realized, even in part, the potentialities of this modern invention. Gradually, however, the necessity of some measure of knowledge and understanding of architecture on the part of the illuminating engineer, and a technical understanding leading to a fuller appreciation of the possibilities of this wonderful illuminant by the architect became apparent. In obedience to this demand a situation has been developed, that is evidenced, at least as far as the engineer is concerned, by the following sentiment which found expression at a recent meeting of the Illuminating Engineering Society in New York:

"'We, who light buildings, must learn to realize what characteristics it is desired to bring out. The shadows must not be too deep, the colors must not be too greatly mixed. We must bring out the ideas which the architect wished to express as clearly at night as they are to be seen by day.'

"It will, probably, be conceded that architects on their part are giving greater study than formerly to the science of illumination, so it would seem that conditions are most favorable for development in a direction that has already progressed to an extent that could not be foreseen or imagined less than a quarter of a century ago."

INTENSITY AND QUANTITY OF LIGHT AND THE EYES; *The Optical Journal and Review,* March 2.

Foreign Items

COMPILED BY J. S. DOW.

NOTES ON RECENT DISCUSSIONS OF THE ILLUMINATING ENGINEERING SOCIETY IN LONDON (*Illum. Eng.,* Lond., February and March, 1911).

Before proceeding to discuss the various items in the general technical press special mention should be made of the recent discussions at meetings of the Illuminating Engineering Society (London) on Library and School Lighting.

The former discussion was introduced at a joint meeting of the Illuminating Engineering Society and the Library Association. Papers were read by Mr. S. L. Jast (honorary secretary of the Library Association and Borough Librarian at Croydon) and Mr. J. Duff Brown (Public Librarian, Islington) on behalf of the Library Association. Subsequently a paper on the same subject was read by Mr. J. Darch, F. S. I.; and Mr. J. S. Dow presented a series of measurements of illumination in the chief public libraries in London.

As an example of co-operation between different bodies interested in lighting problems this meeting was probably unique. The plan followed of devoting one evening's discussion to the views of the architect librarian and a second evening to the engineer's standpoint, led to many different opinions being brought out. The chief recommendations arising from the discussion are summarized in an editorial in the March number of the London *Illuminating Engineer.*

The measurements detailed by Mr. Dow included tests of the illumination on the reading tables in each interior, of the illumination on the shelves and of the details as regards consumption of electrical

energy per square foot. Such interiors as the British Museum, the Patent Office, the Guildhall, as well as a number of public libraries, were studied. It was found that in most respectably lighted libraries a minimum illumination of about 2 foot-candles existed, and it was recommended that for ordinary reading purposes a value of three should be specified, while even higher values would be desirable for fine work (as, for example, in the Patent Office Library, where detailed plans and specifications have to be examined). One weak point in many libraries visited was the presence of bright specks of light which caused "glare," and it was generally agreed that naked filaments, etc., ought invariably to be shaded.

Another question that was much discussed was the relative merits of general and local illumination, the general consensus of opinion being that for reference libraries, as opposed to reading rooms, a combination of the two methods was the ideal system.

A particular problem for study was shelf lighting. Tests showed that the distribution of illumination was usually very uneven and that the lights were often placed so as to trouble the eye. Mr. V. H. McKinney described a form of metallic reflector designed to screen the eyes from the source and yet produce absolutely even illumination over a vertical plane. It was suggested that the illumination given to shelves should be 1 — 1½ foot-candles.

The next question taken up by the Illuminating Engineering Society was School Lighting. A paper dealing with the daylight illumination was presented by Dr. K. James Kerr, medical education officer to the London County Council, and Dr. N. Bishop Harman dealt with artificial illumination, describing different arrangements of lamps and varieties of shades used for the purpose. The discussion was again of an interesting character. Representatives of the London Teachers' Association, the Association of Medical Officers of Health, the Association of Teachers in Technical Institutions and the Association of Technical Institutes taking part. A series of data collected in various London schools and colleges is to be presented by Mr. L. Gaster and Mr. J. S. Dow at the next meeting, when the discussion will be resumed. One point elicited in the last discussion was that the old minimum of 1 foot-candle is too low and that over 2 foot-candles is already obtained in most well-lighted schools.

Illumination and Photometry

Some Notes on Interior Lighting, by Prof. H. Bohle (*Illum. Eng.*, Lond., March, 1911).

The author presents a large number of curves obtained in rooms equipped with different kinds of wall paper, and shows their bearing on the distribution of illumination secured by various groups of lamps.

Nachtrage zur Theorie des Kugelphotometers, by E. Dyhr (*E. T. Z.*, December 23).

The author discusses in detail some points regarding the theory of the globe photometer raised at recent meetings of the Illuminating Engineering Society in London. For example, the question of the effect of incomplete diffusing qualities of the internal white coating and of the window glass. He finds that the error from the various causes examined is small, and concludes by expressing the view that the square box suggested by W. E. Sumpner will not answer.

Ueber Einige Neuere Physikalische Prokektions - Demonstrationen, by W. B. v. Czudnochowski (*Phys. Zeitschr.*, January).

The author describes an apparatus for the projection on the screen of solid objects, pictures, etc. Even such phenomena as fluorescence are said to be capable of exhibition.

Geradsichtiger Lichtstarker Monochromator, by H. Du Bois (*Zeit. f. Instrumentkunde*, January).

The author describes an apparatus for producing a bright patch of monochromatic light; the intensity and quality of the light can be altered at will by a simple adjustment.

Einfaches Kontrast-Photometer, by H. Krüss (*J. f. G.*, February 11).

Describes a simple form of contrast photometer based on a similar device to that used in Wild's flicker photometer (*Illum. Eng.*, Lond., Vol. I, 1908, p. 825). The essential point is that a flat surface is presented to the lights, and angle errors are avoided.

INNENBELEUCHTUNG VON GUTERWAGEN WAHREND DES LADENGESCHAFTES, by Lasser (*E. T. Z.*, January 19).

Describes electrical methods of arranging for the lighting of goods trains while loading. One plan is to run two bare conductors down the station at a certain height and tap them at convenient points by connections attached to a long bamboo; outlets for tapping with a plug connector are also provided under the platform.

ILLUMINATION, by W. E. Marchant (Paper read at the Liverpool Engineering Society; *J. G. L.*, January 31).

ACCUMULATORS AND PORTABLE PHOTOMETERS, by A. P. Trotter (*Electrician*, January 13).

A letter in reply to that previously sent by Dr. C. H. Sharp, quoting experience to show that sufficiently accurate results can be obtained from illumination-photometers without a portable accumulator being necessary.

ZUR FRAGE DER PHYSIOLOGISCHEN BEDEUTUNG ULTRAVIOLETTER STRAHLEN (*Z. f. B.*, January 10).

SPECIAL TREATMENT IN ILLUMINATION (*J. G. L.*, January 24).

LIGHTING OF PUBLIC LIBRARIES (*G. W.*, January 21).

BON ECLAIRAGE, BONS YEUX (*Rev. des Eclairages*, January 15).

LIGHTING PUBLIC LIBRARIES (*Electrician*, January 27; *J. G. L.*, January 24 and February 7).

COMMONSENSE ILLUMINATION (*J. G. L.*, February 7).

LIGHTING OF SCHOOLS (*J. G. L.*, February 21).

Electric Lighting

DIE ELEKTRISCHE BUHNENBELEUCHTUNG IM KONIGLICHEN OPERNHAUS IN BERLIN, by F. Brandt (*A. E. G. Zeitschr.*, January).

DAUERVERSUCHE AN METALLFADENLAMPEN, by O. Brandt (*Elek. Anz.*, January 15).

DIE NEUEREN BESTREBUNGEN ZUR VERWOLLKOMMUNG VON VAKUUM-METALLDAMPFLAMPEN, by B. Duschnitz (*Elek. Anzeiger*, January 15).

THE EXPERIMENTAL LIGHTING OF GOWER STREET, LONDON, by K. Edgcumbe (*Electrician*, January 20).

Experiments on gas and electric lighting have been proceeding in Gower Street. The author gives results of some photometer tests of the illumination in the two cases, and contends that more uniform illumination is attained by electric light.

LA LUMIÈRE FROIDE DE MOORE, by M. Leblanc (*Lum. Electrique*, January 7).

"TURNING DOWN" ELECTRIC LAMPS, by H. D. Wilkinson (*Electrician*, January 6).

ELECTRIC LIGHTING DURING 1910 (*Electrician*, January 13).

NEONBELEUCHTUNG (*Elek. Anz.*, January 22).

Describes the use of the gas, neon, in Moore tubes. The resultant light has a deep orange-red tint which, it is suggested, would be very serviceable for use in conjunction with mercury vapor lamps.

BOGENLAMPEN MIT EINGESCHLOSSENE LIGHTBOGEN (*Z. f. B.*, January 30).

Describes some new patents on enclosed flame arc lamps.

THE BRUSH QUARTZLITE LAMP (*Electrician*, January 6).

THE "WOTANLAMPE" (*J. f. G.*, December 24).

THE ELECTRICAL EQUIPMENT OF THE PALLADIUM (*Electrician*, January 20).

Total Reflektor, System Hrabowski fur Offene Bogenlampen (*Z. f. B.*, January 20).

Gas Lighting

Testing Incandescent Mantles, by J. H. Coste and W. E. F. Powney (*J. G. L.*, January 10).

A paper read before the Society of Chemical Industry proposing a standard specification for gas mantles. Various shocking machines are described, and it is suggested that some regular course of vibration should be prescribed for mantles to undergo before selection. Periodic tests of candle-power are also proposed.

Die Zukunft des Leuchtgases, by W. Eisele (*J. f. G.*, February 4).

A discussion of the future of gas for lighting, etc. The author foresees the spread of high pressure lighting and the ultimate adoption in every town of both a high pressure and a low pressure supply. One of the greatest needs of the industry is still a really reliable and perfect means of automatic ignition.

Platin-Gasselbstzunder fur Hangendes Gasgluhlicht, by W. Grix (*J. f. G.*, December 31).

Grix describes the application of the self-lighting system to inverted mantles. This requires special care, and a number of details have to receive attention, particularly the removal of the material from the hot zone immediately after use. He claims that this apparatus was used for sixty-five days, in the course of which 443 kindlings took place without any sign of deterioration.

Elegante Strassenbeleuchtung an Strassenuberspannungen, by G. Himmel (*J. f. G.*, February 11).

Describes the method of arranging high pressure lamps on wires spanning the street, special link work being provided to bring the lamp to the side and lower it when needed.

Der Elektrische Gasdruckfernmelder, by F. Lux (*J. f. G.*, December 24).

The Development of Incandescent Gas Lighting, by W. J. Pickering (*J. G. L.*, January 17; *G. W.*, January 21).

Hygienic Aspects of Gas Lighting and Heating, by F. S. Toogood (*J. G. L.*, February 21).

Automatically Lighting Street Lamps (*G. W.*, January 28).

The Automaton Lamp Lighter (*J. G. L.*, February 7).

Neuere Verfahren fur zur Herstellung von Gasgluhkorpern (*Z. f. B.*, January 30).

The Present Position of Acetylene (*J. G. L.*, December 27).

Newcastle Automatic Lighting (*J. G. L.*, January 10).

Lowering Gear for Large Lamps (*G. W.*, January 14).

Contractions used:
Elek. Anz. *Elektrischer Anzeiger.*
E. T. Z. *Elektrotechnische Zeitschrift.*
G. W. *Gas World.*
Illum. Eng. Lond. *Illuminating Engineer (London).*
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
J. G. L. *Journal of Gaslighting.*
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The
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THE CONSERVATION OF HUMANITY

Modern civilization in its highest form is the result of modern science. Ancient civilizations reached a high state of perfection for the FEW in the abstract and idealistic phases of life; modern civilization seeks THE GREATEST GOOD TO THE GREATEST NUMBER—"good" referring to the material conditions for physical welfare and happiness.

Society was formerly divided into two classes, master and slave; to-day the only masters are physical disability, indolence and ignorance. The old civilization took no account of the value of human life of the slave or the working class, other than as a loss of abundant and cheap material; modern civilization, based on science, looks to the individual as the foundation of the whole social fabric.

For the worker to waste his energy or health by reason of conditions which can be readily removed or improved is a direct violation of the fundamental law of our present system of human economics. The toll of life and health which industry takes in its yearly march is nevertheless far beyond the limits of the exigencies of fate. There are thousands of lives annually sacrificed to carelessness and gross negligence, and many thousands more suffer temporary or permanent physical injury or discomfort from wholly unnecessary causes.

There is no single cause that contributes more to these deplorable results than insufficient or bad illumination. This is no mere generalizing, but the positive conclusion from an abundance of facts and figures.

Fatal and other accidents directly traceable to want of illumination are sufficiently well authenticated; but there is a vast field of bodily ills and injury that arise from a cause so insidious as to generally escape attention. The eye is so faithful a servant to the body as to often suffer in silence. The part which eye-strain plays in the innumerable cases of ills that baffle the physician's skill, beyond giving them a name, is unquestionably large, and almost wholly neglected.

Injury to the health of the individual not only transgresses the law of human conservation in the first instance, but may readily transmit its effects through generations to come. Human life and health are precious; light is cheap. The exchange of the latter in any amount necessary to conserve the former is therefore the most elementary of problems in political and social economics.

Let us have more and better light!

E. L. Elliott.

Illumination and Industrial Accidents

By E. Leavenworth Elliott.

The subject of industrial accidents has been receiving greatly increased attention during recent years. This may be probably traced to the greater activity of the indemnity insurance companies, to the generally widening efforts on the part of industrial corporations in looking after the welfare of their employees, and to the successful agitation for legislation on employers' liabilities.

The results of the most reliable statistics available indicate that there are a half a million industrial accidents a year serious enough to demand attention on the part of those injured. What number of them are accidents to the eye is not so definitely known, but it lies somewhere between 1 and 8 per cent. It is altogether probable, therefore, that there are at least 20,000 more or less serious injuries to the eyes of workmen through accidents in this country each year.

The most important observation on these statistics is the fact that by far the greater number of industrial accidents of all kinds are preventable, and that therefore this enormous maiming and crippling of greater or less degree is largely unnecessary. The greatest achievement of science in the twentieth century will be the general conservation of human health and strength through the prevention of disease and accidental injury. Curing a disease is like stopping a leaky dam from the outside; it may serve a temporary purpose, but there is no telling how soon the water may break through again. The first and best aid to the injured is to prevent them from being injured. The correlative of the word conservation is prevention.

Among the basic causes of industrial accidents insufficient or bad illumination unquestionably stands first, since it furnishes the conditions favorable to innumerable mishaps. For this general cause there is absolutely no excuse. Ignorance of statute law is not accepted as a plea on the part of an offender, and surely ignorance of so obvious a fact as the contributory negligence evidenced in bad illumination should not be accepted even as a "mitigating circumstance" in placing full responsibility for its effects. The factory manager who does not know that bad lighting increases the probability of accidents, and that artificial lighting can now be secured which practically reproduces daylight conditions, is not sufficiently well posted on the general subject with which he is dealing to justify his holding his position.

One of the most recent and valuable contributions to the subject of industrial accidents is a paper presented February 14, before the American Society of Mechanical Engineers, by Mr. John Calder. The section on "Insufficient Lighting" is so valuable that we reproduce it in full:

"Insufficient lighting is a cause of numerous accidents, particularly serious and fatal falls. The author has observed that a maximum of accidents occurs toward the close and beginning of each year—that is, during November, December and January, the months of minimum daylight. Fig. 1 shows the seasonal distribution for three successive years of about 700 deaths annually from industrial accidents which were reported with other injuries from an area embracing 80,000 plants of varying extents.

"The influence of the duration and intensity of natural light in working hours on fatal and serious accidents is particularly noticeable in such founding, bridge building, shipbuilding, engineering and steel and iron works and other operations as have to be carried on within large spaces, often entirely in the open air and not easily illuminated artificially to the exclusion of deep shadows.

"Within plant buildings the intensity of artificial lighting at the cutting point of tools, for instance, and on very limited machine tool or bench areas is frequently far above actual requirements and a source of much physical discomfort, while all around the operative a semi-darkness prevails which has a blinding effect in the sudden transitions of the vision required by his employment.

"It has been found by exact photometric observations of shop lighting conditions both during the day and at night, that the concentrated illumination by means of shades of ordinary 16 c.p. incandescent units on cutting tools in machines and the area near them is often several times the intensity of

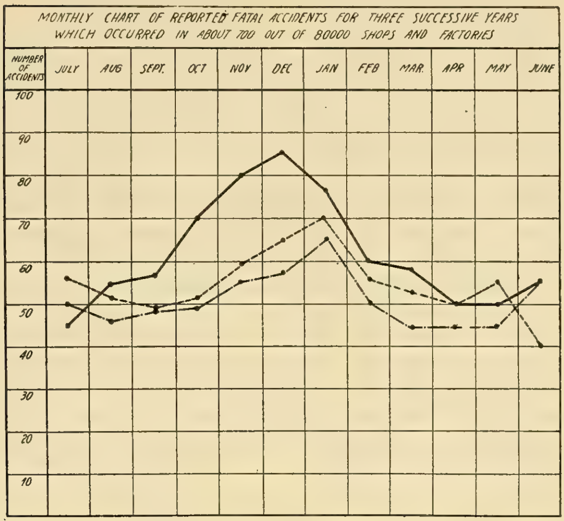


FIG. I.—INFLUENCE OF DAYLIGHT ON ACCIDENT.

ordinary daylight on the same parts. It is very difficult to convince the operative that he is suffering from too much light at any place and the call is constantly for more light.

"What is wanted from the safety point of view and also, the author believes, from considerations of power economy, is the elimination by good illuminating engineering of this excessive hard light on spots only, which causes eye-strain and poor vision of surrounding areas with resulting accident. A more generally diffused light of less unit intensity is now easily obtained by the use of fewer but larger screened units experimentally located to suit varying shop requirements and reflecting from whitened wall and ceiling surfaces. The mechanical engineer administering industries or designing plants can do much to reduce the accident risk from this cause."

The peculiar evils of artificial lighting particularly pointed out by Mr. Calder are worthy of most careful consideration. He speaks particularly of accidents in work that is to be carried on either in the open, or large inclosures, which are " not easily illuminated artificially to the exclusion of deep shadows." While it may possibly not be quite so easy to do away with the dangerous shadows in such cases, it is far from being impossible. The flaming arc lamp and the Cooper-Hewitt lamp, used in sufficient number and with a proper engineering skill, will produce an illumination which will not measurably increase liability to accidents over the ordinary daylight conditions in the same places.

The use of intense special lighting with generally dark surroundings is a faulty illuminating engineering practice which was rather favored in the earlier days of the science when " efficiency " (referring only to the cost of light) was the slogan of the profession. The paper presented by Mr. Louis B. Marks before the Illuminating Engineering Society, in which a large number of measurements were taken in a typewriter manufacturing plant, and which showed a generally higher degree of artificial illumination than the daylight intensity, were a surprise to most illuminating engineers as well as laymen interested in the subject. Notwithstanding this greater intensity it is doubtful if there is a single workman who would not rather work with daylight. Wherein lies the superiority of natural illumination? There can be but one answer to this question—*in its perfect diffusion.* The inference is plain; in order to produce the best results with artificial lighting we must approximate as nearly as possible this superlative quality of natural light.

Indirect lighting is often impracticable for industrial use owing to the condition of the air and the character of the walls and ceilings. Under such circumstances the safe method must therefore be to se-

cure the largest possible radiating surface with the least possible intrinsic brilliancy. Care in regard to ceilings and walls, however, need not be omitted, but rather should always be exercised to keep them in as clean and white a condition as possible.

It is just beginning to be understood that of all "efficiencies" that of the "human machine" is the most important, and that compared with this the cost of light is an inconsiderable item.

The statistics gathered by Mr. Calder show beyond any question of doubt that bad or insufficient illumination is the direct cause of many hundred deaths annually in the industries, to say nothing of other serious accidents. The curves shown in Fig. 1 are susceptible of no other conclusion. The one year in which there was a larger total number of accidents (represented by the solid line) was probably one of the more prosperous when there was necessarily a larger amount of night work.

So far as these fatal and other accidents were due to bad lighting, there is no question of criminal negligence on the part of those responsible. That it is negligence is sufficiently plain to any engineer or layman who will give himself the trouble to compare the cost of the best of artificial lighting with the other operating expenses of an industrial plant. The proportion is too insignificantly small to furnish the slightest excuse, and where there is no excuse for conditions which produce death or maiming there is certainly criminal negligence.

There is a large and increasing amount of attention being given to general welfare work throughout the industrial field, and it will interest those who have imagined that no good can come out of a "trust" to know that some of the large corporations which have been most under the muck-raker's hetcheling have been foremost in the work of affording the greatest possible safeguards to their employees.

In spite of this voluntary work, however, legislation is unquestionably demanded; laws are not for the innocent and the well-intentioned, but for the dangerously negligent and unscrupulous, and there will always be a certain irreducible minimum of this latter class which need the strong arm of authority to keep them in line. Of all unsanitary conditions bad lighting is the most positively injurious and dangerous, barring the actual presence of contagious disease, and it should therefore receive first attention in all legislative regulations looking toward sanitation.

A decidedly unique but effective method of securing proper sanitation of factories has been undertaken in New York City during the past year. This is the action of the Garment Makers' Union in appointing a Board of Sanitary Control for the purpose of determining the existing conditions in the various factories and workshops in this industry, and making such regulations as seem wise and expedient. A special committee of this board, composed of experts in the various subjects, has been at work on the problem for some months, and a code of requirements will soon be formulated. Although it has entirely escaped mention in the public press, an event occurred which may be epochal in its results. During the past winter one of the smaller workshops was found to be in a generally unsanitary condition and the employees were ordered out by the union, with the result that the place was immediately closed up and the manager moved into other and better quarters. This method of securing a proper observance of good lighting and other sanitary measures has some manifest advantages over the ordinary legal processes. In the first place, there is no lack of inspectors with full authority; every individual workman is an inspector. In the second place, the remedy is quick and certain, and in the third place, the sympathy of the public will be a unit in upholding all reasonable efforts of this kind on the part of the unions, and it is a well-established fact that without such sympathy the actual power of a labor organization is very limited. Such action will, therefore, greatly strengthen organized labor in the eyes of the public.

The Quartz Lamp

By R. F. Pierce.

The Quartz lamp possesses peculiar interest from the fact that, if it achieves the commercial success of which it gives great promise, it will practically accomplish what the tungsten lamp has begun—the obsolescence of the electric arc lamp. In this connection, of course, the term "arc lamp" is intended to refer to those types of electric lamps in which the electrodes are consumed at an appreciable rate during the burning of the lamp.

Mechanically the Quartz lamp is simply a mercury vapor lamp in which the envelope is made of fused, transparent quartz, instead of glass. Electrically it exhibits marked dissimilarity, however, and authorities differ as to the proper classification of the two. Vogel regards the mercury vapor lamp with glass tube as a "vapor" lamp, and the Quartz lamp as a true arc lamp. There is much to be said in favor of this distinction—at least for practical purposes—yet it would certainly be confusing to refer to the Quartz lamp as an arc lamp, in view of the fact that this name is so widely applied to an entirely different sort of apparatus.

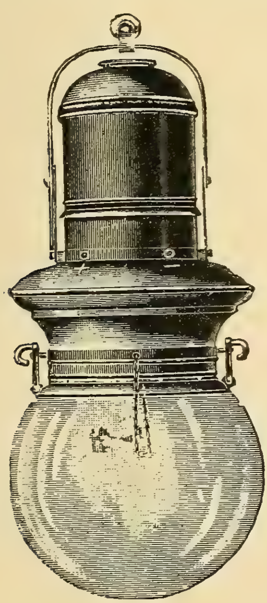


FIG. I.

The Quartz lamp differs from the mercury vapor lamp in several essential particulars. The form of the efficiency curve is entirely different. In the mercury vapor lamp, the watts per candle-power reach a minimum with an input of about 20 watts per inch length of tube, and efficiency rapidly decreases if the input is either lowered below or raised above this point. The Quartz lamp behaves as a true arc and within experimental limits the watts per candle-power decrease by regularly decreasing increments, with each increase in input. It is reasonable to suppose that at some point between the watts input per unit length of tube utilized in the mercury vapor lamp, and that of the Quartz lamp, a radical change in the nature of the electrical phenomena involved takes place.

The Quartz lamp utilizes a tube of much smaller dimensions than the mercury vapor lamp. For 110 volts a tube 1 to 1.5 cm. in diameter and 8 cm. long is used in the former, as compared to a tube 3 to 5 cm. by 110 cm. in the latter. In the Quartz lamp, therefore, the voltage drop per cm. of length of tube is about 13 as against 1 in the mercury vapor lamp. This results in a much higher temperature and pressure. In the mercury vapor lamp the pressure is about 2 mm. In the Quartz lamp as constructed at present, the pressure is about one atmosphere and the extraodinarily refractory qualities of the quartz permit it to be raised to two atmospheres without fusing the quartz envelope. At this point, however, mercury vapor begins to escape.

The specific energy consumption of the Quartz lamp, as usually operated, is about .25 watts per mean lower hemispherical hefners—about equal to that of the flaming arc, and about half that of the mercury vapor lamp.

The light emitted by the Quartz lamp

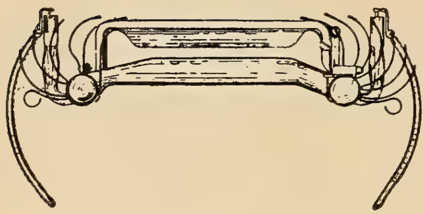


FIG. 2.

is much whiter than that from the mercury vapor lamp, and with increased temperatures the color is steadily improved.

The Quartz lamp is the logical outcome of the efforts to improve the efficiency and color of the mercury vapor lamp by operating at higher temperatures. On account of the low melting point of glass an envelope of greater heat-resisting qualities was sought and quartz was found after much experiment to be available. In fact, the invention of the Quartz lamp is usually ascribed to Dr. Kuech of the firm of Heraeus, Hanau, Germany, pioneers in the development of fused quartz ware for laboratory purposes, although Dr. C. P. Steinmetz of Schenectady has claimed priority.

The valuable commercial characteristics of the Quartz lamp result directly from the high temperatures obtained. In this lamp the band spectrum characteristic of luminescent mercury vapor at low temperatures is markedly modified, being overlaid by the continuous spectrum of pure temperature radiation. This not only produces a much greater amount of light for the same current consumption, but adds an appreciable quantity of red rays, which are entirely lacking in the mercury vapor lamp.

Difficulties Encountered in Developing the Lamp.

Many difficulties were encountered in the development of a commercial type of Quartz lamp. Quartz, being extremely refractory, is very difficult to fuse into the thoroughly liquid condition required in the manufacture of a glass free from air bubbles and imperfections, and its manufacture is correspondingly expensive. In addition to its heat resisting qualities, it has, however, one other very essential feature—transparence to ultra-violet rays. Ordinary glass being opaque to these rays is rapidly disintegrated by the energy transformed into heat by the absorption of these rays, which are present in the Quartz lamp to an even greater extent than in the mercury vapor lamp.

Another difficulty was presented in the securing of a proper material for leading-in wires. Quartz, having a zero temperature-expansion coefficient, required the use of conductors of similar characteristics. This was found in the nickel-steel alloy of Guillaume. Improved methods of manufacture have made it possible to produce, on a commercial scale, thoroughly satisfactory tubes of quartz, and practical methods of filling and sealing-in have been developed, and a commercial form of the Quartz lamp has been on the European market for two or three years.

One commercial drawback is the fragility of the tubes, which rarely withstand the rough handling received in ocean transportation. This has prevented the importation of lamps even for experimental purposes, except in the cases of those returning travelers who are personally willing to nurse the burners through the ocean voyage. In burners shipped by ordinary channels breakages ran as high as 90 per cent. Special methods of packing have, however, been devised which, to a great extent, overcome this trouble and perfectly withstand the handling received in ordinary transportation.

About 10,000 of these lamps are now in use for illuminating purposes in Germany, principally in factories, foundries, steel mills, piers and docks, and their use is rapidly increasing, one factory alone turning out about 500 lamps per month.

The usual guarantee regarding burning life is 1,000 hours, but the average is stated to be between 2,000 and 3,000 hours, and in some cases 5,000 hours and more have been obtained.

Cost of Maintenance.

An idea of the costliness of the burner may be obtained from the fact that burners are replaced at a price of 25 mk. ($5.75) when the old burner is returned. Otherwise the charge is 130 mk. ($32.90).

The complete lamps sell at about 200 mk. ($46) each (list), and are made in

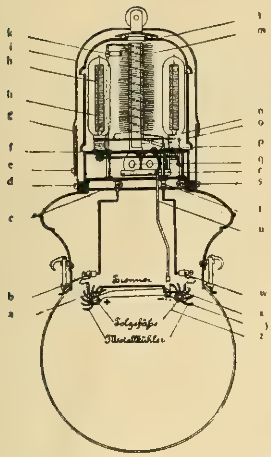


FIG. 3.

three sizes—4 amp., 110 volt; 2½ amp., 220 volt; and 3½ amp., 220 volt, the candle-power ranging from 1,200 to 3,000.

Mechanical Construction.

Mechanically the Quartz lamp is extremely simple. The only moving part is the armature of the magnet controlling the tilting mechanism by which the lamp is started, and another armature which operates a cut-out, throwing the tilting magnet out of circuit when current is established through the burner. Fig. 4 shows these features diagrammatically.

Switching on the lamp energizes the magnet " q," attracting the armature " r " and tilting the tube so as to cause a stream of mercury to bridge across " x " to " a," establishing a current strong enough to magnetize the choking coil " l " to such a point as to attract the armature " o " carrying the cut-out " p " and breaking the circuit through the starting magnet " q," thus returning the burner to its original position, breaking the bridge of mercury and establishing an arc between the mercury electrodes. The function of the resistance " m " is similar to that of the line resistance of the ordinary arc lamp. A " ballast " " h " composed of iron wire windings in an atmosphere of nitrogen mounted in a tubular bulb in ordinary incandescent lamp sockets is also provided, the purpose of which is to limit the rush of current at starting, for which purpose the high temperature resistance coefficient of iron is admirably adapted. Fig. 3 shows the arrangement of the parts and illustrates the neat appearance and compact arrangement of the unit. Fig. 5 shows the starting characteristics of the lamp, curve " f-k " being the supply voltage, curve " h-i " the voltage across burner and ballast, and " c-d " across burner alone. " f-g " is the curve of lamp wattage, " c-e " of burner wattage, and " a-b " of ampereage, all referring to the 220 volt, 3½ ampere type.

It will be seen that the maximum burner voltage is reached in about six minutes, and that the energy consumed becomes steady in about ten minutes, which is about the time required for the lamp to come up to full candle-power.

The radial wings at " a," Fig. 3 (also shown in Fig. 2) are the metal " coolers " which provide radiating surface for maintaining the ends of the tube at constant temperature, and are bent together in pairs (thus reducing the cooling surface) when the lamp is to be burned outdoors.

It will be noted that the Quartz lamp is remarkably free from mechanism or other devices subject either to deterioration or uncertainty of action. The only feature which militates against its universal adoption is the color of the light, and this is really far less objectionable than one would expect considering the character-

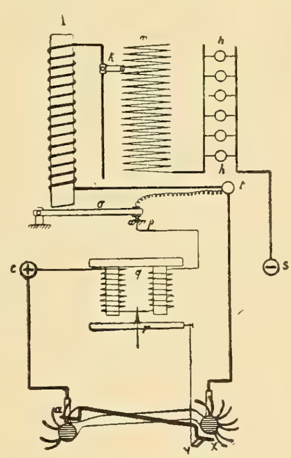


FIG. 4.

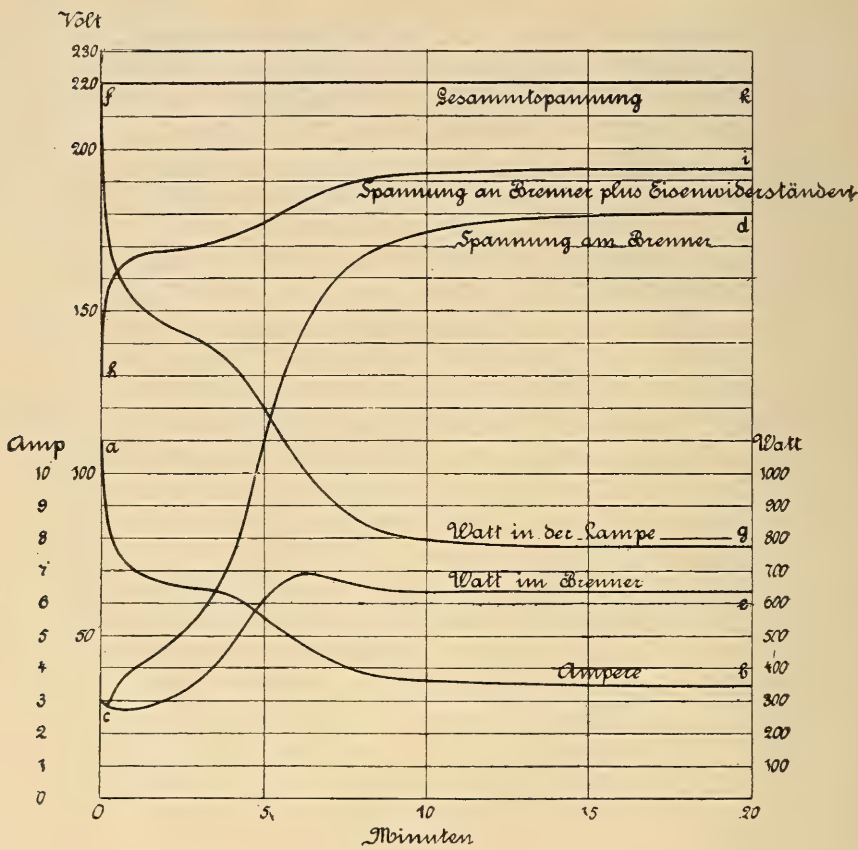


FIG. 5.

istics of the mercury arc. Quite naturally, much effort has been directed toward improving the color of the light. In general, two means are suggested to the desired end. First, raising the temperature of the arc, and second, the addition of metals which contribute red rays.

The introduction of other metals is accomplished by amalgamating them with the mercury. Much trouble was experienced in finding suitable metals that would not form alkaline silicates and destroy or at least corrode the tube itself. Sodium, strontium, lithium, etc., the most obviously suitable, were found impracticable on this account.

The following amalgam is now utilized with good results in a commercial type of lamp, giving nearly white light at substantially ¼ watt per cp. or equal to the most efficient type of flame arc:

Mercury	60	Parts
Lead	20	"
Bismuth	20	"
Tin	½	"
Cadmium	½	"

The quartz burner when filled with this amalgam will produce a pure white light for 100 to 200 hours, but after that period the metals contributing red rays gradually diminish in effectiveness, and the spectrum of pure mercury is shown.

It is reasonable to expect that further developments will considerably increase the effective life of the amalgam, and with improvements in the quality of the quartz glass the present pressure should be nearly doubled. This would also greatly improve the quality of the light and the efficiency. In fact, a specific energy consumption of .16 watts per mean lower

hemispherical c.p. before has already been reached experimentally.

Light Distribution.

The distribution of light from the Quartz lamp is substantially the same as that of the inclined carbon flame arc. It would be entirely feasible, however, to alter this to any desired degree by the use of reflectors, prismatic or otherwise, placed inside the outer globe, where they would be entirely protected from dust. There being no deposit of any nature generated inside the lamp, there would be no fouling from this source.

The Quartz lamp appears to be freer from inherent shortcomings than any other type of illuminant now on the market. It combines efficiency, long burning life and freedom from mechanism to an extent hitherto not even remotely approached, and with excellent prospects for improving the color of the light its commercial possibilities are certainly attractive.

As the tungsten lamp has practically ousted the inclosed arc lamp, and in the 500-watt size is even replacing the flame arc in many places when the time required in trimming is a matter of great importance (such as in steel mills, etc.), it may be conservatively stated that if the possibilities of the Quartz lamp are realized to the degree which now seems fairly well assured, the arc lamp must practically disappear except for an exceedingly limited class of work.

The limits of the arc lamp of both efficiency and life, appear to have been already reached, at least in so far as existing indications go. At least, no promising means of improvement in either respect is disclosed by any recent research on the subject.

It is stated, on what is believed to be excellent authority, that the Quartz lamp will be placed on the American market on a commercial scale in a very short time, and, as several well-known engineers have been very favorably impressed by the results of their investigations of the lamp in Europe, it is very probable that it will be an important factor in American practice in a very short time.

Pseudo-Testimonials

By Francisco Laurent Godinez and Albert Jackson Marshall.

Since time immemorial the "testimonial letter," of almanac origin, has added to the afflictions of that longsuffering mass of humanity fondly designated as "the public."

Fostered by the unrelenting and premeditated avidity of the manufacturer, the practice of "testimonializing" has survived until in recent years the attack of the United States courts has, in a measure, limited the field of its activities. While it is true there have appeared many bona fide expressions of public opinion in testimonial form, these have been few and far between, and the pseudo-testimonial—criminally conceived and mendaciously executed—is yet a serious menace to the advancement of civilization. True, the publication of the bona fide article is quite legitimate, but the present day tendency, on the part of representative corporations, is to avoid such cheap publicity, in view of the odious comparisons engendered by associated ideas.

The Patent Medicine Testimonial.

Legislative investigations have pointed out the fact that "the patent medicine advertisement is not alone written with particular intent to emphasize the curative properties of the remedy, as to actually convince the unfortunate reader that *he,* himself, is afflicted with the disease."

The $50,000 verdict in favor of *Collier's Weekly* vs. the Postum Cereal Company is still fresh in the minds of those misguided individuals who, like Orpheus, turned back—to observe that mystic phrase, "There's a reason!" It has been shown conclusively that "testimonials" are, at times, not only prescribed, but subscribed for, in large quan-

tities—there being various set forms commercially available to advertise for the thousand ills which human flesh is heir to—all incidentally carefully prepared in a most ingenious and appealing form. Many of these "testimonials" are mere lying statements—others plain forgeries —and the balance written in good faith, perhaps, by those who at the time were either convinced of some personal benefit derived, or were actuated by a vain desire for the publicity obtainable from the appearance of their names and faces in public places.

In some instances, however, the remedies undoubtedly afforded some real or imaginary benefit to the user, but, in the main, the testimonials might properly be characterized as ignorant or mendacious statements.

The pamphlet published and circulated broadcast by *Collier's Weekly*, entitled "There's a Verdict," describes how the "testimonial" of a "medical expert" for the Postum Cereal Company was obtained for a fee of ten dollars. And the defendants further proved that this same "expert," after a limited practice as a physician, had ingloriously retired, after achieving what might be termed a brilliant failure in the medical profession, and was actually engaged in some other occupation at the time he wrote his "expert opinion."

The mere statement or "testimonial" of any professional man, be he physician or physicist, amounts to naught but an expression of opinion unless he can qualify as an expert to the satisfaction of the court. The technical graduate, armed cap-a-pie, with slide rule and price book, is commercially heralded as an "illuminating expert"—but his too scientific achievements in the promiscuous application of illuminating engineering have made the mere mention of that profession offensive to his victims—the merchants.

"Experts"—and Experts.

The real expert is he who exercises judicially that broad and accurate knowledge acquired through years of practice, based perhaps on the fundamental training of the institute of technology, but tempered and modified by the broad perspective acquired by an adherence to the sterling principles of discretion, intelligence and originality.

These, then, are the characteristics which differentiate the "commercial" engineering expert from the engineering specialist of recognized standing—the distinguishing mark between the skilled practitioner and the quack doctor, yet the overzealous manufacturers, with a supreme indifference, worthy of a better cause, still persist in holding the mirror up to nature in an attempt not to disclose her as she is, but as she *ought to be*, assuming a doctrine which in the case of "patent medicine" exploitation has as limiting functions only—the growth of limbs and the creation of brains.

There can be no more contemptible, not to say criminal, act than such advertising on the part of any individual or corporation, and while the manufacturer has the indisputable right to properly negotiate his wares, when, however, these wares are distributed not only for the purpose of accomplishing mere physical results, but also with a base ulterior motive, then it is indeed time to call a halt. Any manufacturer's product, influencing in the slightest degree the health or moral welfare of the general public, should invariably be substantiated by the most comprehensive, honest and authentic proof obtainable. The mere parrot-like reiteration of stilted phrases by members of a sales force is not sufficient to inspire an unwonted degree of confidence in the minds of an intelligent reader.

In the lighting world we have also been afflicted with the "testimonials," imitations of the "patent medicine" and "pure food" variety, but as yet, fortunately, the practice has not reached the stage where any great amount of business has been attained through such methods. There are about as many persons who have knowledge of the fundamental laws and principles involved in the proper use of artificial light as there are those qualified to pass judgment on the value of patent medicine and pure foods; nevertheless some manufacturers will persist in presenting "testimonials" that to the people of refinement and education are nothing short of ludicrous. One of the most ignorant

statements ever incorporated in "testimonial" form was recently set forth in a letter (supposedly written by a surgeon) relative to the lighting of hospital wards. While we have frequently been regaled by various poetic illusions on the part of those commercially interested in the exploitation of what has been termed by some "indirect" and by others "inept" lighting, evidently the saturation point has yet to be attained.

Indirect Lighting Not a Panacea for All Lighting Ills.

While a studied effort has been made to convince the public regarding the efficiency of indirect lighting as a panacea for all lighting ills, the burden of proof still rests with the manufacturers, they having as yet failed to do more than liberally emphasize the distinction between a "fact" and an "opinion"—without enjoying the benefit of the doubt, and to-day there is a crying demand for facts, proof—honest, reliable data obtained from real scientific investigations on the part of recognized physicists—scientists and ophthalmologists.

Ad interim, it evidently became the stern duty of the surgeon alluded to above to rush madly into the breach, offering himself recklessly as a vivacious sacrifice on the altar of science by "testimonializing" in a fervid manner decidedly worthy of detailed inquiry. This supposed guardian of health narrated, in substance, how indirect lighting in *hospital wards* represented the acme of perfection—the last word in the philanthropic hygiene of vision. Now it is difficult to realize how any sane individual could honestly feel justified in praising such a lighting scheme for such an interior. If this learned guardian of health would but attempt to lie flat on his back and to recline "at ease" in a ward so lighted, with an endless expanse of glaring ceiling above him, he would speedily appreciate the lack of intelligence displayed by his avowed appreciation of such a scheme. There is, perhaps, no class of interior where indirect lighting is more thoroughly undesirable than in the wards of hospitals, and this (our) statement we think is thoroughly appreciated by any one who has intelligently analyzed the subject.

Indirect lighting, like any radical innovation, undoubtedly has its uses, but, like everything else, it does some things well, others not so well, quite a few badly, and many others worse, hospital ward lighting included in the latter class. In other words, *indirect lighting should not be considered a universal panacea for all lighting ills.*

To assert that indirect lighting is "easy on the eyes," without noting several exceptions, is prostituting commercialism to a statement that has not been substantiated by the impartial research made by those qualified to analyze the many grave physiological and psychological problems involved.

Since childhood the eye has been accustomed to direct radiation from visible light sources—and demands the pleasing contrast between light and shadow as instinctively as a plant leans toward the light.

Necessity for Shadow.

Just as it is necessary to perceive evil in order to recognize good, so is it necessary to have shadow in order to appreciate light. The very basis of art is the beautiful contrast afforded by light and shade. Remove the shadow and at once we eliminate that vital characteristic which for ages has been an unalterably established psychological precedent—and one which, at least, will never be shattered by the "testimonial"—particularly those obviously constructed for sales promotion, and relative to the misuse of artificial light in hospital wards, where those unfortunates, fighting to regain their health, are handicapped by unnatural lighting conditions.

Indirect Lighting in an Insurance Company's Office

BY WALTER NORMAN GOLDSCHMIDT.

FIG. I.—TYPE OF UNIT USED IN PRIVATE OFFICES.

Among the notable lighting installations in offices employing indirect lighting is The National Life Insurance Company, Chicago.

These offices originally were as dingy and dismal as any that could be found in a modern office building, and many a system had been tried, until finally indirect lighting was chosen. The first lights were placed in a vault with an idea of ascertaining to what extent a uniform diffusion could be accomplished in rows of fireproof documents, files extending from the floor almost up to the ceiling. This being successful, the whole office has been laid out with this system, using in the entrance lobby a chain bowl, whereas in the general offices a stem type of fixture permitting the use of two, three and four-light units were decided upon. The private offices are all single bowl type units.

The National Life Insurance Company occupies the rear half of the ninth floor of the building bearing its name, same being approximately square, windows on three sides, fourth side opening to corridor at the right of which is a small suite of private offices and vaults. On the north side the full depth of the office are the actuary's room and the private room of the officers of the company, the president's room being in the extreme northwestern corner.

The entrance hall, having an area of 368 sq. ft., is lighted by four 100-watt lamps contained in two bowl-type fixtures with Greek border design (as shown on Fig. 1). The use of 400 watts in this area occasions the use of 1.1 watt per square foot, which figured at .4 of a watt per lumen shows foot-candle intensity of 2.7 foot-candles. However, this entrance being ordinarily so dark as to admit very little daylight, and being finished in very light colors, looks considerably brighter than this intensity would indicate. In fact, a glance from any part of the public corridor is sufficient to hold the eye and permit a closer inspection of the interior shown on Fig. 3.

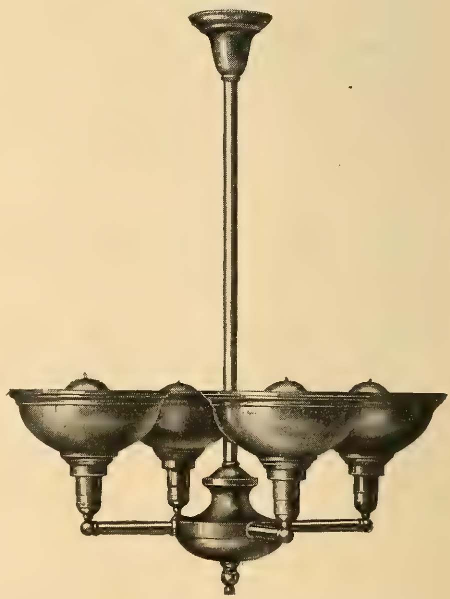


FIG. 2.—TYPE OF UNIT USED FOR GENERAL ILLUMINATION.

FIG. 3.—EFFECT OF NEW INDIRECT ILLUMINATION IN THE MAIN OFFICE.

The general offices, 63 x 54 ft., are made 448 sq. ft. less by cutting out one corner for the vault. In this general office, actual area 3434 sq. ft., the total wattage 5600 means a consumption of 1.6 watts per square foot, which, figured at 45 watts per lumen, produces approximately 3.6 foot-candles. This intensity is produced by the means of the use of stem fixtures (see Fig. 2), ten of which are provided with four 100-watt lamps hung 30 in. top of the reflector to the ceiling, and two 2-light and three 3-light fixtures, each containing 100-watt lamps.

This view was taken from the office showing the top of the bowl fixtures in the entrance hall over the grille work of the bookkeeping department in the background of illustration (see Fig. 3). You will note that all control are on the pillars or switches on the wall, as the case may be, and that in no case are desk lamps or wall brackets or auxiliary lights of any kind necessary.

Fig. 4 illustrates a narrow passage, showing the grille work of the bookkeeping department in the back, and fireproof document cases on either side rising from the floor almost to the ceiling.

The clearness of this picture seems remarkable; you can easily count each individual board in the floor in spite of the distance of the nearest lighting fixture from the camera seen in the upper left-hand corner of the cut. In the lowest document drawer the farthest from the nearest source of light, headings on documents can be read with ease without removing same from the drawer.

Generally speaking, this installation is a wonderful example of excellent uniform diffusion, and will bear out the contention of admirers of well engineered indirect lighting installations that the quality of this light is the nearest yet known to daylight.

To Mr. Crittenden, secretary to the President, much credit is due for the re-

arrangement of this office. Employees are now very well contented no matter in what portion of the office they are located. Visitors, without exception, express their admiration of the results accomplished.

Mr. Lay, the office manager of the National Life Insurance Company, stated to the writer that he has handled office forces for 20 years, and that "all direct lighting appliances he has been forced to work under have been simply h—l; that never before now has he had an office that was satisfactorily illuminated."

President's room is lighted by shallow bowl type fixtures in palm leaf design (Fig. 5) containing six 60-watt lamps. Area of room is 224 ft. This figures out at 1.6 watts per square foot, using .50 watts per lumen (glass on two sides), giving an approximate foot-candle of 3.2 intensity light equally diffused throughout the room.

This room is exactly the same in size and in treatment as the actuary's room, and the location of these rooms in relation to the general offices, as shown on the general plan (Fig. 6). On this general plan the location of outlets is shown and the number and wattage of tungsten lamps employed in each fixture.

FIG. 4.—EFFECT OF ILLUMINATION IN FILING DEPARTMENT.

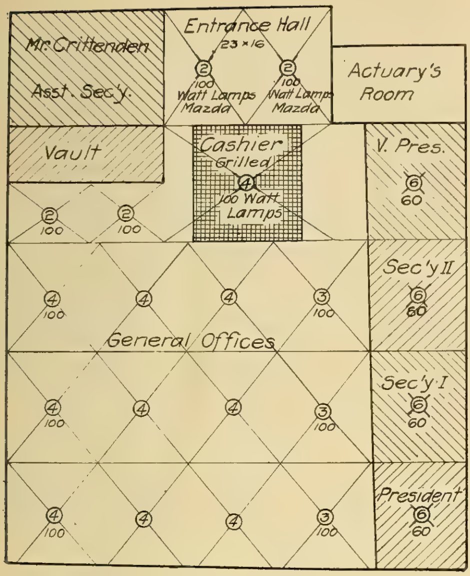


FIG. 5.—FLOOR PLAN OF OFFICES—BAY 14′ X 16′.

Chicago, like other Middle West cities in which bituminous coal is used, suffers more or less from the "smoke nuisance," which increases the necessity for greater attention to cleanliness in the care of lighting installations. This has sometimes been urged as a handicap to indirect lighting; but to this there are two answers: First, no lighting system will continue to operate with normal efficiency without being kept clean. This applies quite as well to the various kinds of lamps, globes and reflectors used for direct lighting as for indirect lighting, and, second, the part which illumination plays in the efficiency of those using it is so great that the item of even the most frequent cleanings necessary to keep the illumination up to its highest standard is not an expense, but an economy. Finally, it may be mentioned that indirect lighting fixtures are more easily cleaned than many forms of direct lighting units.

A Review of a Recent Paper on "The Lighting of a Large Store"

By Norman Macbeth.

The writer was somewhat interested in reviewing the paper on "The Lighting of a Large Store" presented before the March meeting of the New York Section of the Illuminating Engineering Society, in the conclusions presented, the tests reported, and in the deductions which he was able to make from same. On page 189 of the Illuminating Engineering Society Transactions for March, 1911, appears the only statement in the paper which could be used with the somewhat elaborate Table V for the determination of the efficiencies of distribution on the various floors: "The outlets are on about 12-ft. centers." Failure to more fully round out this statement was evidently an oversight, resulting from the limited time available in the preparation of the paper, as other not more important statistics were given most completely—the number of flights of stairs and their combined length; the area of the plate glass used and the city blocks it would cover; the number of steel columns and their combined height; the cubic feet of rock excavation; the length in feet and miles of circulation pipe for the heating system; the amount of mahogany lumber used for fixtures, counters, tables, etc.; the exact number of showcases and their combined length; also the number and length of wall cases and counters.

Spacing of Outlets.

A glance at the twenty floor plans illustrated will show that the outlet spacing north and south is approximately five-sixths of the east and west spacing, and on reference to the section plan, Fig. 3, page 188, a scale may be determined which, when applied to the various floor plans, would seem to warrant the assumption that the pillars are on 23-ft. centers east to west and 21-ft. centers north to south. This would result in an area per bay of 483 sq. ft. The difference between this assumption and that with an outlet

spacing of 12 ft., with pillars on 25-ft. centers each way, is about 23 per cent. Assuming, then, that the area of 483 sq. ft. per bay is correct, and that the values given in Table V for the "approximate mean horizontal foot-candles" are representative, the wattage per bay and the resultant calculated values will permit the conclusion that this installation is, in many respects, a remarkably efficient one.

Sections with 60-Watt Lamps.

Bringing the various sections together, where similar size lamps were used, we have, on the main floor under balcony and on the four sections of the eighth floor shown by plans, Figs. 5, 39, 42 and 43, using 60-watt bowl frosted lamps in 10-in. ground glass balls, a wattage per square foot, based on the nominal rating for tungsten lamps at middle voltage, of .497 and resulting in an average horizontal illumination of 2.15 foot-candles, an efficiency of 3.8 to 4.8 effective lumens per watt, or an average of 4.3 lumens effective per watt, which is 65 per cent. of the total flux of the lamp when equipped with the sand blasted balls here used. The absorption loss for the average 10-in. ball used on these outlets was shown to be but 13 per cent. This was also the loss "assumed" with the 10-in. balls used on these outlets when operated with new lamps.

Sections with 100-Watt Lamps.

Taking up the four sections equipped with 100-watt bowl frosted lamps in the basement under balcony, seventh floor and basement mezzanine, shown on plan, Figs. 44, 38, 30 and 48, where 150-watt opal reflectors were used on the first two locations, with 150-watt satin finished prismatic reflectors and 150-watt clear prismatic reflectors on the two latter, the watts per square foot (nominal rating) was .827. The average horizontal illumination was 3.55 foot-candles, with the opal reflectors resulting in 4.25 lumens effective per watt, and with the satin finished prismatic reflectors 4.1 foot-candles, with 5 lumens per watt. These reflectors show an absorption loss of 15 per cent. The clear prismatic gave an average illumination of 4.5 foot-candles and 5.4 lumens per watt effective. The latter average intensity was assumed by the writer, having been omitted from the table. The measured loss due to the reflectors was 14.5 per cent.

Sections with 150-Watt Lamps.

The 150-watt tungsten lamps used in the basement, second, third, fourth and fifth floors shown on plans, Figs. 49, 12, 13, 14, 18, 21 and 28, suffered badly from depreciation, off-rating, or both. The bare lamps as reported in the paper delivered but 69 to 79 per cent. of their nominal rating, the average of the seven sets of tests being over 28 per cent. below the rated output at middle voltage. The average mean illumination values with the 10-in. balls on the first five locations with the 150-watt lamps was 3.64 foot-candles, with 4 foot-candles with the opal reflectors and 4.1 foot-candles with the satin finished prismatic reflectors. The watts per square foot for these floors was 1.24 and the average lumens per watt, 2.92 for the balls, 3.2 for the opal reflectors and 3.3 for the satin finished prismatic reflectors.

The average lumens per watt values with the 150-watt lamps show a considerable drop below the first sets here noted.

Lumens Per Watt Values.

Auxiliary.	60 and 100 watt lamps.	150-watt lamps.
Ground glass balls...	4.3	2.92
Opal reflectors.......	4.25	3.2
Satin finished prismatic reflectors....	5.03	3.0

First Floor, 250-Watt Lamps.

The tests on the main floor where 250-watt bowl frosted lamps in 14-in. ground glass balls were used show rather high efficiencies. The total absorption of these balls was given as 11 per cent., and the average horizontal illumination 9.3 foot-candles with all lamps on; the watts per square foot, 2.07 for the entire floor, or 1.035 for the floor as most generally used with half of the lamps on. The lumens per watt, accepting the values as given in the table, would therefore be 4.5.

The 250-watt lamps separately tested were shown to be off-rating or to have depreciated 21 per cent.

Available Information.

The nominal watts per square foot is about the only concise information which can be taken from this paper, as the authors specifically state on page 216: "Wherever test stations are so located, or the distribution is so uniform that the numerical average of all is thought to yield a fairly representative value, an average of all test station values is shown. These values, however, do not purport to be true mean foot-candles for the test area." In Table I are given figures relative to the absorption factors which would be of interest:

Table I.—Light Absorption in Per Cent.

Clear glass	5 to 10
Ground glass	20 to 30
Alabaster glass	20 to 50
Opal glass	25 to 60
Milk glass	30 to 80

The actual absorption figures reported in the paper from measurements of sample glass removed from the installation to the laboratory was as follows:

	Per cent.
Ground glass, 14-in. balls	11
Ground glass, 10-in. balls	13, 15 and 16
Clear glass prismatic reflectors	14½
Satin finished prismatic reflectors	13 and 15
Opal reflectors	19

Efficiency of Reflectors and Globes.

The results here given also fail to agree with Table III, page 203. "In comparing one system with another, using Scheme No. 1 as representing 100 per cent. efficiency, these values indicate approximately the relative per cent. of illumination produced on the goods for equal consumption of electricity."

Table III.—Efficiency of Arrangements.

	Per cent.
Clear prismatic reflectors	100
Satin finished prismatic reflectors	85
Light ground glass balls without reflectors	30

Comparing the above values with the figures worked out by the writer, and assuming the lumens per watt as stated above with the various size lamps equipped as follows, the 10-in. sand blasted balls with the 60 and 100 watt tungsten lamps, instead of showing a comparative effective efficiency of 30 per cent., as given in Table III, show nearly 80 per cent.

Source.	Lumens per watt.	Per cent.
60 and 100 watt lamps and clear prismatic reflectors	5.4	100
Satin finished prismatic	5.0	92.5
10-in. sand blasted balls	4.3	79.5
250-watt lamps and 14-in. sand blasted balls	4.5	83.
And with 150-watt lamps assuming the satin finished prismatic with	3.3 at	92.5
10-in. sand blasted balls	2.92	82.

It would be interesting to know also why the results from the 150-watt lamp tests were so far below those secured with the 60 and 100 watt lamps, using the same glassware and presumably under somewhat similar conditions of installation and service.

It is hoped that in the subsequent paper partially promised that the authors will incorporate some such values as are given above, which, with the complete test reports at their disposal, would undoubtedly be more consistent.

Such values and conclusions may readily be omitted from a paper of this kind, as they are, after all, perhaps of greater interest to the practical illuminating engineer and the central station man than to the "anti-wattage" engineer, and while not all important in the description of such a noteworthy installation, may at least claim equal interest with the very complete unique statistics mentioned so fully in the opening pages of the paper.

FIG. 1.—CATHEDRAL CHURCH OF ST. JOHN THE DIVINE. DAY VIEW OF CHOIR AND SANCTUARY.

Lighting the Largest Church in America

BY W. H. SPENCER.

The Cathedral of St. John the Divine, situated on Morningside Heights in New York, will be, when completed, the largest church edifice in America and the fourth largest in the world, being excelled by St. Peter's in Rome, and the Cathedrals of Seville and Milan. The portion of this cathedral already completed was dedicated with due pomp and ceremony on April 19. In its artificial lighting devices this church will stand unique among religious edifices of the world. The oft-repeated anecdote of Martin Luther, that "He could not see why the devil should have all the good music," might be aptly paraphrased in this case, the architects evidently not being willing to give his Satanic Majesty a monopoly of spectacular lighting, which has heretofore been one of the chief assets of the play-house. The illumination of the finished portion has been worked out on exactly the same lines as the lighting for a given setting in a theatre, i. e., to bring out to the fullest extent possible the im-

pressiveness of the architecture, and harmonize the illumination with the nature of the service.

The lighting of the chancel, which is 124 feet from the floor to the top of the arch, is accomplished by a continuous special reflector lined with corrugated silvered glass installed back of the piers on either side, and of the arch at the ceiling. The height and inaccessibility of the structure rendered some special method of replacing lamps necessary. This is accomplished by an ingenious arrangement by which the sections of the reflector can be readily lowered and lamps replaced, thus bringing each section within reach of a man standing on the floor. These two lines of reflector constitute the entire lighting installation for the sanctuary and choir, which is 58 feet wide and 124 feet high, containing over 877,000 cubic feet of space. 334 16-c.-p. carbon lamps are used. These lamps are operated by remote control switches. Alternate lamps are connected to a dimmer, and the intervening ones are sub-controlled by automatic switches. The lamps are also divided into sections, so that every possible variation of illumination can be obtained, the switches being operated from a closet back of the choir screens.

Fig. 1 shows a daylight view of the interior. As will be noted, the ceiling is almost entirely hidden in shadow.

FIG. 2.—NIGHT VIEW OF CHOIR AND SANCTUARY, SHOWING DETAIL OF COLUMNS BROUGHT OUT BY ARTIFICIAL ILLUMINATION.

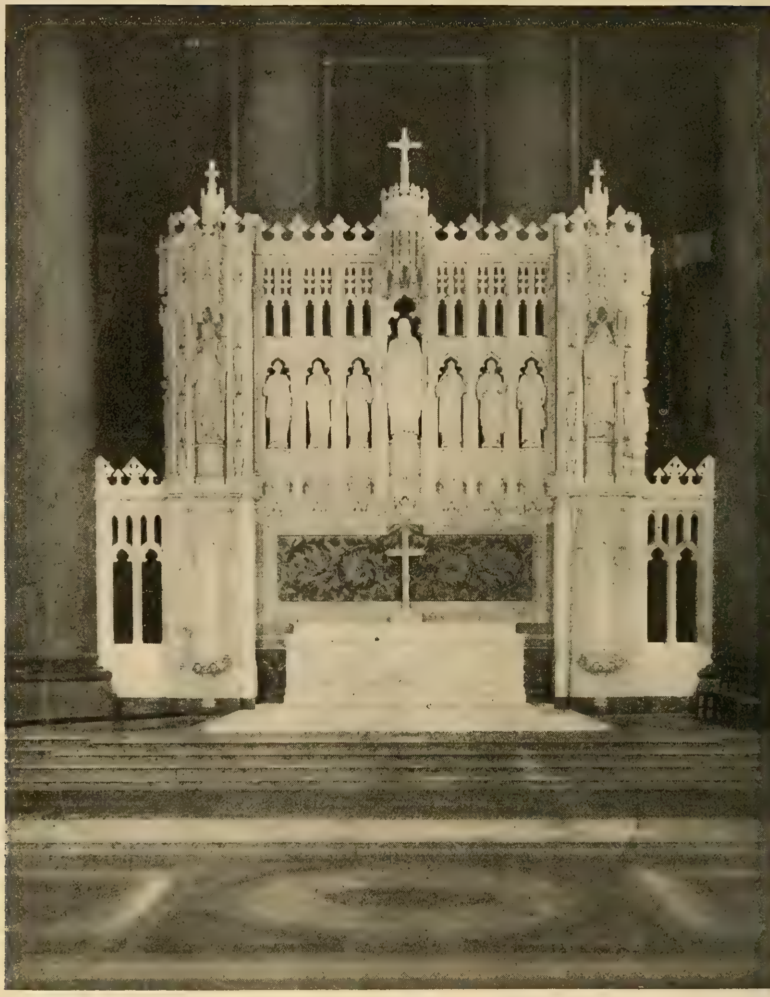


FIG. 3.—THE SANCTUARY.

Fig. 2 is a view of the choir and the sanctuary illuminated with the artificial lighting. Not only is the dome of the roof fully illuminated, but both the architecture and perspective are admirably brought out.

Fig. 3 is a nearer view of the sanctuary showing how fully all the details of the pillars, columns, and carving are retained.

Fig. 4 is a view of the altar taken by artificial light. This is probably the most exquisite work of its kind in America, having cost the neat sum of $250,000.

A study of the illumination of this master-piece of modern ecclesiastic architecture recalls a statement made in regard to the illumination of the Soldiers' Memorial in Pittsburgh, to the effect that it is quite as legitimate to create psychological impressions by the use of light as by the use of sound. If a pipe organ is an appropriate instrument for a church, with all its infinite mechanism for affecting the emotions through the sensation of hearing, then why not a system of illumination which can arouse emotions through the finer sensibilities of the organs of vision? The greatest master of stage management in this country, if not in the world, to-day, is David Belasco, and it is known that he would think nothing of spending two hours in a rehearsal in obtaining a certain

FIG. 4.—NIGHT VIEW OF CHOIR AND SANCTUARY, SHOWING THE WONDERFUL ILLUMINATION OF THE DOME, NOT A LAMP IN SIGHT.

desired effect of light, as, for example, the darkening of a room resulting from a person going upstairs with a lighted candle.

There has been a great deal of discussion of the problem of church lighting, since the preservation of the architectural effect is admittedly an important item. The only satisfactory solution of the problem seems to be the one here exemplified, viz., of absolutely suppressing all visible light-sources. It is perfectly safe to assume that the illumination will be entirely agreeable to the eyes from the hygienic standpoint, as well as appealing to the higher emotions.

A comparison of the day and night views is most interesting. In the former the dome of the ceiling is scarcely visible; in the latter, not only the dome, but all the architectural details stand out like a well lighted picture. The beauty of the altar is likewise fully preserved.

The canopies above the seats for the clergy in the choir have a space covered with a disc of amber glass, which harmonizes with the oak woodwork so as to be scarcely noticeable by day. Behind these glass screens 16-candle-power lamps are placed, which give a beautiful mellow glow by night, illuminating both the seats and their occupants as by softened sunshine.

Another absolutely unique feature is the artificial illumination of the four large windows over the organ. Some twenty feet back of these there are rows of lamps in silvered glass reflectors, the lamps being connected with dimmers so as to vary the intensity of illumination.

The lighting of this church is perhaps most notable in being a direct contradiction of the principle that has been so frequently and forcefully maintained by a certain element in the lighting fraternity, which has insisted that "historic feeling" could never be superseded in the lighting of monumental buildings. Here is a structure distinctly historic in its architecture and devoted to a purpose which would naturally lend strength to motives of precedent and custom; but the architects have chosen to entirely ignore this view of the case, and to take every possible advantage of modern methods of illumination. The original Gothic church was scarcely lighted at all artificially in its earlier forms, and later the "crown" chandelier, which developed into huge proportions before it was discontinued, measured the extent of mediæval ability in artificial lighting. The best reproduction of this historic fixture is probably to be found in Dr. Parkhurst's church in this city, which was designed by the late Stanford White.

Light itself is certainly ancient enough to satisfy any one's demand for historic feeling, and every visible modern light-source is a hopeless anachronism when used with ancient architecture. Illumination without visible light-sources thus obviates this anachronism, as well as conforming to the most approved principles of ophthalmology and illuminating engineering.

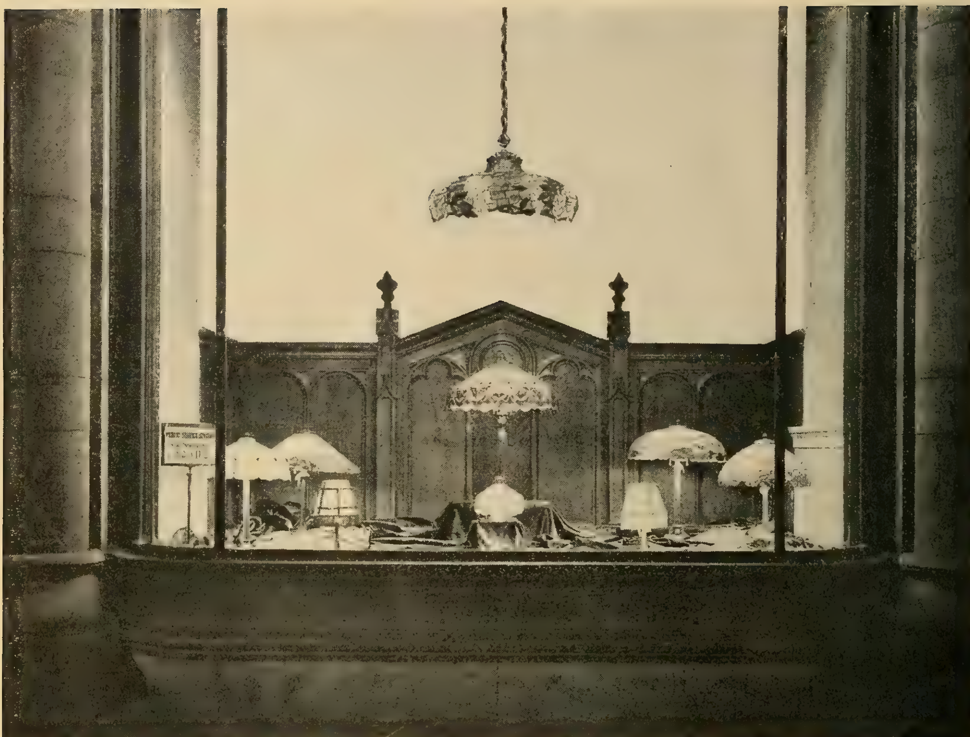


FIG. I.—ONE OF THE SHOW WINDOWS, NEW PUBLIC SERVICE BUILDING, NEWARK, N. J.

The New Offices and Display Rooms of the Public Service Corporation of New Jersey at Newark

These rooms occupy the ground floor and basement of the fine new building erected for the corporation's use at Broad and Bank Streets. The general motive of the architecture of the building is Gothic, modified to meet modern conditions. The walls and ceiling are of light buff with gold decorations. The fixtures are of bronze, the wainscoting of marble, and the floors of mosaic.

Fig. 1 is an exterior view of one of the show windows displaying portable lamps.

Fig. 2 is a section of the main office. The illumination here is by both gas and electricity. The question as to which is the gas and which the electricity may serve as an interesting puzzle not only to the reader but to the person visiting the room. The fixtures are uniform throughout, inverted mantle lamps being used in connection with tungstens. This is an impressive proof of the statement so often made in these columns, that gas in the great majority of cases can be made as effective, artistic and otherwise, as any other illuminant.

Fig. 3 shows a section of the display room, which is likewise lighted by both gas and electric lamps. The effect here is equally good.

Fig. 4 shows the demonstration booths designed to bring out the effect upon the general illumination of a room by different wall coverings.

The architecture, which is unusual outside of ecclesiastical structures, gives a distinct touch of freshness to the artistic treatment, which is fully carried out in the lighting fixtures. The general avoidance of over-decoration or over-crowding

FIG. 2.—SECTION OF MAIN OFFICES.

FIG. 3.—SECTION OF THE DISPLAY ROOMS.

in the display adds still further to the attractiveness of the installation.

The whole scheme has been well planned and admirably carried out. Those responsible for it have ample grounds for feeling well satisfied with their accomplishment. It is not only highly creditable to the corporation, but it is an ornament and a credit to the city as well.

The exhibition rooms are, of course, intended to display all of the apparatus and their uses for both gas and electricity. The rooms thus become a permanent exhibit of an educational character, as well as a mere showroom of merchandise.

Modern methods of merchandising are as different and as far in advance of the old notions of trade and barter as modern science is ahead of ancient guess work. Every up-to-date merchant is now in a way a public educator, and among such none are more active, progressive and useful in their results than the companies producing luminants. To improve the physical conditions in which people live is in reality a greater force for moral betterment than philosophizing, no matter how moral its tone and purpose. Modern illumination will do more for general uplift than all the scholastic arguments ever put forth. The lighting company is by force of circumstances a public benefactor; there is absolutely no escaping the fact that physical light brings moral light in its wake.

A display room of the kind here described is a school room, and a public lecture room as well, whose influence for good in the community is by no means measured by the dollars which it brings into the company.

FIG. 4.—DEMONSTRATION BOOTHS.

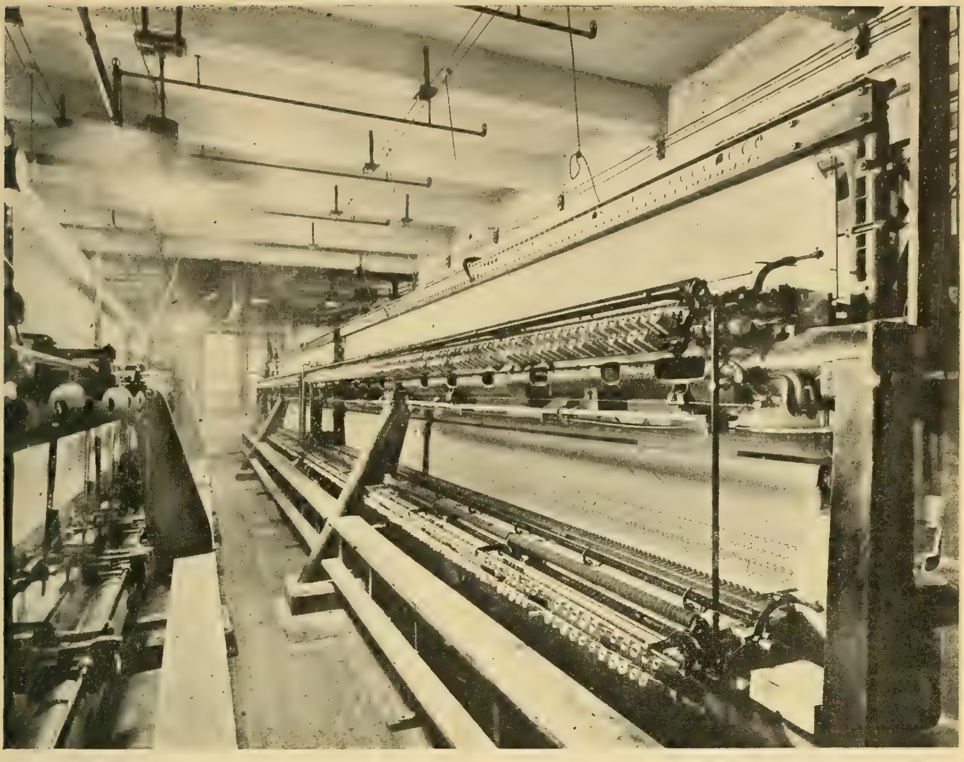


FIG. I.—PERSPECTIVE VIEW OF EMBROIDERING MACHINE TAKEN BY COOPER HEWITT LIGHT.

The Lighting of An Embroidery Factory

By A. S. Hubbard.

There are few if any pieces of machinery in use in the industrial arts containing so large a number of delicate parts as the wonderful mechanism used in producing embroideries. Unlike textile goods, in which the operations are transverse to the length of the fabric and hence comparatively short, embroidery machinery operates over the entire length of the "piece."

It is evident that the proper operation of such a machine as the one shown in the illustration requires the best possible conditions of illumination that can be obtained. Distinct shadows must be eliminated, and all fine details of both material and machinery brought out with unfailing clearness.

In the case illustrated, the Cooper Hewitt lamp is used for the artificial lighting. This solves the problem in a very satisfactory manner, since the large extent of light giving surface removes and prevents sharp shadows, and the color quality of the light adds to the acuity of vision. Such an installation may well be considered a good part of the "scientific management" of such a factory.

The problem of illumination for machine embroidery is much simpler than many of the other textile problems, in that the question of color does not have to be reckoned with. It is a mistake to suppose, however, that white surfaces are easier to see than those that absorb more or less of the light. As a matter of fact, by affording less contrast in light and shade, extremely fine white detail is more difficult for the eye to resolve. The danger of too high intensity is also a real one.

Exhibition of the American Association for the Conservation of Vision

A public exhibition by this association was given in connection with the exposition of the New York Association for the Blind, which was held in the Metropolitan Opera House, New York, from April 26 to 29. The exposition was opened Wednesday evening by President Taft, who was introduced in a felicitous speech by the Hon. Joseph H. Choate.

The exhibit of the association for the Conservation of Vision was the first public appearance of this organization, and was necessarily very hastily assembled. A large number of particularly fine photographs were exhibited showing the various phases of protecting the eyes from contagious infantile blindness to defective illumination. Perhaps the most instructive feature was the model school room, which was fitted with all necessary provision for protecting the sight of the pupils. Three systems of artificial lighting were shown; namely, indirect illumination with mantle gas burners, direct lighting with electric lamps in metallic reflectors so arranged as to throw the light over the left shoulder of each pupil, all the lamps being hidden from direct view; and the direct system largely used in Boston, consisting of prismatic reflectors placed on the ceiling, the reflectors having reflecting surfaces turned toward the pupils and transmitting surfaces on the other side. A booklet on the "Conservation of Vision," giving plain and simple directions in regard to the care of the eyes, including diseases, optical defects and eye-strain from defective illumination, was distributed to all visitors.

The following paragraphs from the booklet show the general attitude of the association to the subject of illumination:

Artificial Illumination.

The first thing is to discharge the mind of all preconceived notions as to this or that light being "hard on the eyes." All light sources in common use are capable of giving an illumination that is perfectly agreeable to the eyes: it is the way in which the lights are used that makes them hard on the eyes. Thus, with the proper appliances it would be impossible to tell whether a room were lighted with oil lamps, gas or electricity. Many people still use oil lamps with the idea that their light is easier on the eyes, the notion still being common that electric light is hard on the eyes. The light of the kerosene lamp is easy on the eyes because such lamps are always placed on tables, and nearly always covered with shades which completely hide the flame; and even if the flame is seen, it is so much less bright than the electric light that it is comparatively harmless. But use an electric lamp in the same way that an oil lamp is used—that is, supply it with the proper shade to protect the eyes, and diffuse the light, and the illumination produced is not only just as easy on the eyes, but cannot be distinguished from that of an oil lamp.

The same conditions applv to gas. Thus, the general notion in regard to gas is taken from the old-fashioned flame jet, which flickers and blows and gives a wavering, unsatisfactory illumination. The modern mantle burner, however, when fitted with the proper shade, gives an illumination which is absolutely steady and of a quality which cannot be distinguished from the best electric or oil light.

Industrial Lighting.

The use of bad lighting for industrial purposes is an outrage on those who work under it, and the cause of serious losses to the manufacturer by reducing the quality and quantity of work which the operative turns out. The cost of good artificial light, even if used during the entire working hours, will not represent more than half of one per cent. of the workmen's wages. The question of cost of the light is wholly inconsiderable as compared with the efficiency of the workmen.

This especially applies to offices and industries employing female labor, for the double reason that such labor commonly requires much careful vision, and the female constitution is more susceptible to nervous strains of any kind.

Great improvements in the production and use of artificial light have been made within the past ten years, and it is now a proven fact that by the selection of the proper light sources and accessories, and their correct placing with reference to those using the light, it is possible to produce conditions of illumination which will enable the eyes to be used with the same degree of efficiency and comfort as by natural light.

Where illumination is to be furnished to a considerable number of people, as in schools, offices, factories, public halls, etc., the services of a competent illuminating engineer should be secured. The directions given for the lighting of the home can gen-

erally be carried out by the householder, and if assistance is desired the local lighting companies can now be depended upon to give safe and sound advice.

The exhibition will be enlarged and shown in other cities, eight applications being already on file. Though not yet two months old, the association shows a decidedly vigorous life and activity.

Indirect Illumination in Europe

By R. F. Pierce.

It is interesting to compare the status of indirect lighting in America and in Germany. Here it has obtained a vogue only during the last two or three years, though during that time it has enlisted some notable adherents. Its application has been confined principally to offices, churches, residences, etc., where the high intrinsic brilliancy of a bare filament would be objectionable. In Germany, on the other hand, indirect lighting has been commercially applied and in a large way, for the past fifteen years, but principally in factories, spinning mills, etc., while for stores, offices and churches, inclosed, open and even flaming arcs are used.

A possible reason may be that in business the Teuton thinks first of efficiency, and the advantages of the shadowless, indirect system make an instant appeal as furnishing an ideal light to work under. Then, too, in the open arc lamp, the use of which is practically universal in Germany, except where very small units are desired, he has ready to hand, the unit of high efficiency, over double that of the tungsten lamp and at least four times that of the inclosed arc lamp in its most efficient form. There being nothing in the nature of underwriters' rules to prevent the interior use of the open arc, and this unit, having been developed to a high degree of perfection in Germany, it stands second to the flame arc in favor, and the results obtained by its use would open the eyes of some American engineers to whom the word open arc connotes nothing but flicker, splutter and general obnoxiousness.

On the other hand, when on pleasure bent, the German wants all the light he can get and where he can see it. The interior illumination of restaurants, concert halls, auditoriums, etc., is quite generally effected by flame arcs. In a number of instances these have been used for the illumination of churches, though possibly in this case they are used for the purpose of putting Morpheus to flight. At any rate, all German public illumination is of a very stimulating sort, while the use of diffused light is generally favored for the illumination of factories and mills where the elimination of shadows and the protection of the workmen from the evils of eye strain is of great importance.

The utilization of large units in German practice is very well advanced, and in this respect we may well take a leaf from the German's book. As regards factory lighting especially, it would appear that the indirect system should have merits worth investigating, although, of course, the open arc is not available for this purpose in America. However, with the available units properly used, a satisfactory *amount* of illumination should be secured at a reasonable cost, and the *quality* of illumination should be unexceptionable. A system of illumination producing such mild shadows as those of indirect lighting would certainly considerably increase the efficiency of the workmen, both by facilitating the inspection and operation of otherwise poorly lighted portions of machinery and by eliminating the eye strain which always accompanies the use of exposed light-sources suspended within the range of vision. To obtain such illumination, the manufacturer could very well afford to materially increase his lighting expense, as the cost of light is normally such an infinitesimal item in general shop expense, that the least improvement in the workmen's efficiency would justify a considerable increase in lighting expense.

The indirect system appears especially adapted to the illumination of loft type buildings, and where a close approximation to daylight color values is desirable or necessary, it is certainly well worth trying out.

Fixtures and Accessories

A Study of Some Recent Designs in Lighting Fixtures

It is all very well to talk about " individuality in art," and berate the plebeian quality of copies. If we were restricted to the possession of original creations the most of us would have as little art to enjoy as the original cave-man. The true artist is a comparatively rare specimen, and it is one of the glories of modern science that it has provided the means of producing such exact copies of original conceptions in art of all kinds that the poorest among us who has the appreciation can enjoy all the beauties of the original work, foregoing only the sentimental pleasure which attaches to the ownership of first-hand productions. We do not think less of the literary value of a book because a hundred or a million others possess a copy from the same plates. In a similar manner we may enjoy the work of a pictorial artist in a copy turned out by the marvelous processes of modern printing or photography. The art of the sculptor ends with the clay model; the copy in bronze or marble which the public sees is the direct work of the expert stone-cutter or molder; and there is no reason why he should not make as many equally good copies as he can work out in a lifetime, or that other equally competent artisans should not do the same thing.

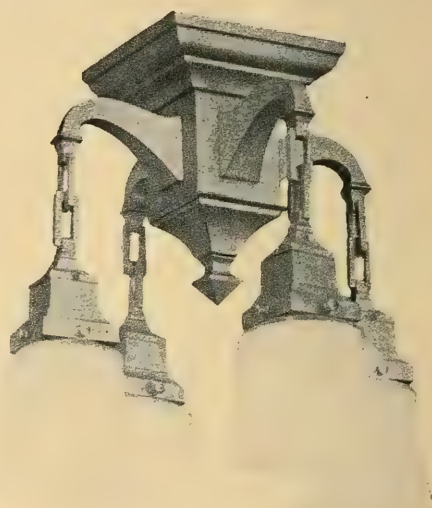


FIG. 2.

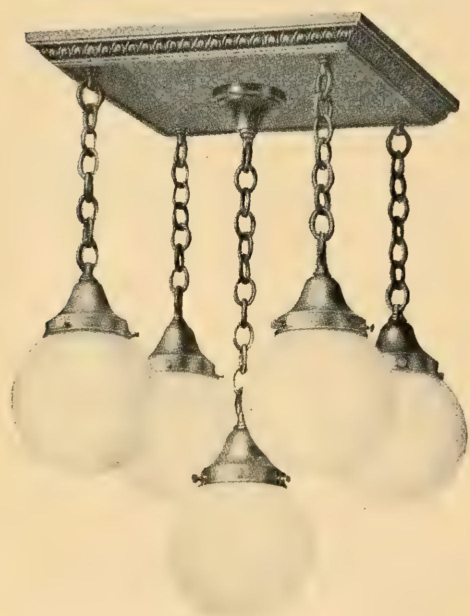


FIG. 1.

To reason from a masterpiece of literature, or painting, or sculpture to a lighting fixture may seem to our matter-of-fact

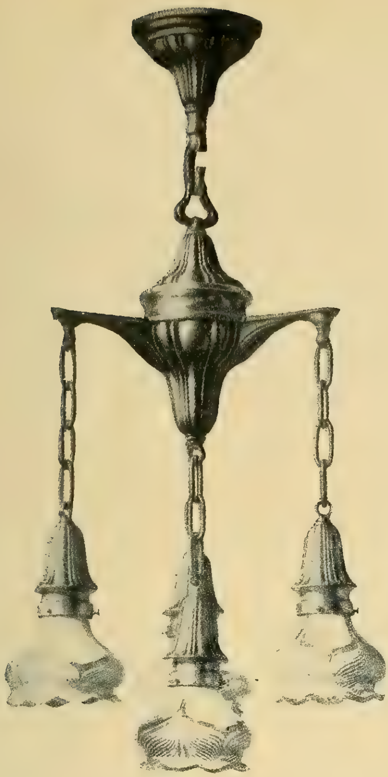


FIG. 3.

Having cleared the decks for action, in other words, having made room on a sufficiently large table to spread out the fixture manufacturers' folios, let us leave them over with passing mention of anything that appeals to our particular fancy. Never mind if there are many that do not have any message for us; we should not like to make intimate friends of every one we met, even of the most select assembly.

Here is one that would look very neat in that Puritan Colonial parlor of yours (Fig. 1). The classical moulding on the ceiling placque would carry out the spirit of the colonial architecture, which is a modified classic, while its general simplicity would accord well with colonial traditions. Let us not forget, however, to use a globe that completely diffuses the light; for to show the streak of the lamp filament through the glass, or a bright spot, especially if not centered, would spoil the whole effect when the fixture was in use, and that is just the time when we most want to appreciate its artistic qualities.

FIG. 4.

readers as being a kind of *reductio ad absurdum;* but it is good logic nevertheless. No doubt we would all be delighted to have a skilled designer originate our particular fixtures and would enjoy that peculiar form of selfishness which arises from the exclusive possession of a thing. But artists of ability, following the general law of supply and demand, command high prices; and unless we have the wherewithall we must needs content ourselves with a mere fraction of the artist's time represented in one of the numerous copies of his original work. In plain words, we shall have to confine our selection of lighting fixtures to the catalogues or stocks of the regular manufacturers, knowing full well that our next door neighbor may perhaps possess himself of the same identical patterns. But if the fixture is good in its design and executed in workmanlike manner, we should be able to enjoy whatever artistic appeal it makes to us quite as much as if it were the only one in existence.

FIG. 5.

If you are inclined toward the "Arts-and-Crafts" school you may find this design interesting (Fig. 2). It would go very well indeed in a dining-room or living-room finished in this school of decoration.

Here is something that possesses a distinct air of grace and symmetry (Fig. 3). The curves are particularly free from conventional restraint, and the flower-like globes sustain the general effect. It would be particularly pleasing finished in old silver, the design suggesting the artistic plate of the Georgian period. It would furnish an appropriate center-piece, and give the keynote to the decoration of a beautiful little reception room, in which soft grays and pearl tints might predominate, the richer coloring of the globes giving just the requisite touch of brilliancy.

The parlor might have this design, which would give a variety without incongruity (Fig. 4). Dull gold would probably be the preferable finish. The design is one which would harmonize with a variety of furnishings, and the arrangement of the lamps is such as to give an abundance of light when wanted, or a moderate amount without throwing the fixture out of balance.

Our next "snap" is a more pretentious fixture, of distinctly classical design, and would become a large living-room of a colonial dwelling (Fig. 5). The link suspension of the lamps is a pleasing innovation without being "freaky." Antique brass would be the most fitting finish.

Of still more elaborate design is our next selection (Fig. 6). This is an excellent combination of strength and grace. The broad attachment of the arms to the central support satisfies the natural demand of the eye for mechanical strength, and the combination of curves gives it the requisite grace.

Of somewhat lighter air, and even larger measure of gracefulness, is this design, the straight line being entirely eliminated (Fig. 7). There is no superfluous decoration, however, and all the lines are exceptionally well balanced.

The Dutch colonial house, when following its ancestors closely, has comparatively low ceilings. This demands a fixture having the horizontal lines extended. Such a fixture we have before us in Fig. 8. The extended line pertains to the glassware as well as to the general construction of the metal work. Brushed brass would be the proper finish. While only chandeliers have been chosen for study in this case, it must be understood that brackets of corresponding design can always be obtained.

Those who are disposed to lament the general lack of appreciation of art in America should compare the designs of lighting fixtures regularly catalogued by

FIG. 6.

FIG. 7.

the better class of manufacturers to-day with those of twenty-five or even ten years ago. Probably we have not yet reached the state of general artistic taste possessed by the Athenians in their palmiest days or the French in the time of the Louis', but we are unquestionably making progress; and we possess a good many off-setting advantages which the dwellers in those earlier times never dreamed of, not the least among which is the ability to produce artificial light so cheaply and of such abundance and brilliancy as to enable every one to enjoy its practical advantages if not all of its artistic possibilities. Rome was not built in a day, nor can a new continent be cleared up and embellished with supreme works of artisanship within the course of a century.

There is ample evidence that the fixture manufacturers are striving to offer better designs to the public, and, on the other hand, that the public are being constantly educated not only to appreciate but to demand better art. This interaction can result in only one thing—a general advancement in all forms of applied art.

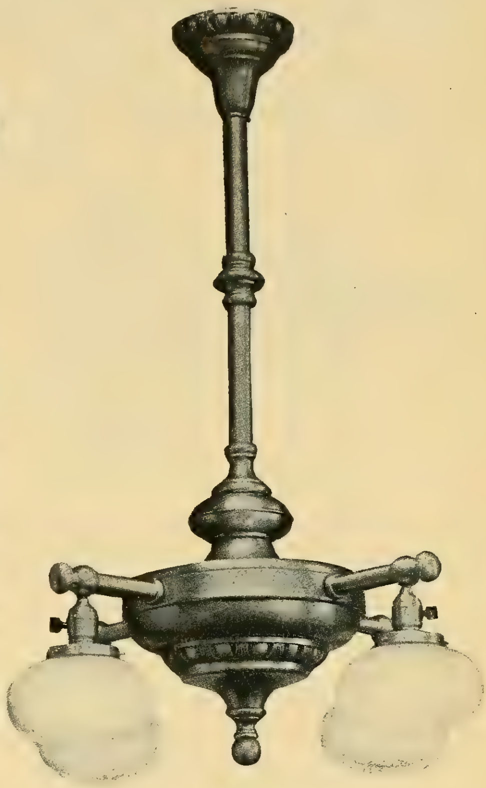


FIG. 8.

Theory and Technology

The Photometry of Colored Light Sources

By S. G. Hibben.

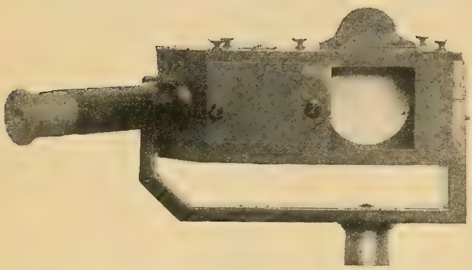


FIG. 1.—LÜMMER-BRODHUN PHOTOMETER.

The subject of heterochrome photometry, and its several closely connected phases relative to colored illuminants, has been taken up here with a view towards furnishing data such as might be useful in commercial illuminating engineering. The photometry of various-colored light sources is a subject which at present affords ponderable investigation. The comfort and pleasantness of decorative artificial illumination; the best economy of light-energy for a given electrical energy; the general health and welfare of the race, are all dependent upon the ability of the engineer to understand the demands of the human organisms of light-perception and to satisfy them. Here it is that an understanding of heterochrome photometry should enter the field of the designing engineer. Again there arise questions of colors and color-acuity in railway and navigation signals, and here it is that the manufacturing engineer is vitally concerned. Publications and conclusions relating directly to the commercial use of a photometer for comparing colored lights are few and meager, and in many cases are of little practical avail, and it is the purpose of this article to add such results as are here found to the knowledge in this field.

Until within the last five years there has been too little attention paid to the particular principles of scientific commercial illumination. Various lighting systems have been brought to a high stage of perfection, but all such systems have been used with an apparent disregard for optical comfort and well-being. With the advent of decorative incandescent lighting and the rapid rise of illuminating engineering there have arisen questions of multi-colored photometry and its physiological aspects, which are of particular moment. Such questions may be summarized as follows: What color, or combination of colors, is best suited for the average vision? Are certain tints restful, while others are most economical, and if so how should we discriminate in residence, street, or signal lighting? Is the eye able to judge accurately of different colored illuminants? And, finally, are there satisfactory means for obtaining practical measurements of multi-colored light sources, and if so, what photometers are best suited for such work? These last two

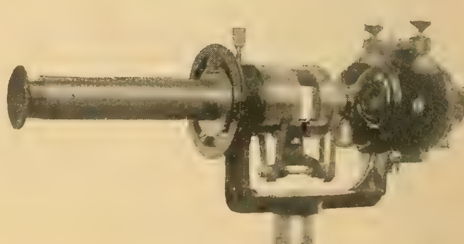


FIG. 2.—FLICKER PHOTOMETER.

questions will be looked into particularly.

The so-called "color error" has been a source of uncertainty for years, as exemplified in the objection to the reddish tint of the Hefner standard, the yellow of the Pentane flame and the blue tints of the electric arc. The original idea in comparing such light-sources was to offset such differences of color by the use of color-screens. Among the earlier investigators, Crova made use of colored glass plates in comparing intensities in limited portions of the spectrum, and at a later date the Bureau of Standards has successfully operated such color screens under Dr. E. P. Hyde. The arguments in favor of interposed color-plates are, that it is just as desirable to have uniformity in the rating of new colored sources, as it is to have a common unit through which the old colored sources have been brought into agreement, viz., it is not so important to know whether certain sources marked 16 candle-power are 17 candle-power, as to know whether a 16 candle-power source of one manufacturer is the same as the similarly rated one of another firm. To dispose color-screens it can be said that such screens must have

a. Uniform transmission.
b. Uniform tint.
c. Permanent tint.
d. Parallel surfaces.
e. Definite spectral absorption.

All of which requirements are practically impossible for commercial photometry. Hence we abandon their use.

In making use of a commercial photometer we encounter two main difficulties: First, the fact that two contiguous surfaces, illuminated by lights of different color-values, appear equally illuminated to one of two observers, but not so to the second observer; and second, it is hard for either observer to decide just when the two surfaces are equally illuminated. The first difficulty can be met by a large number of observers, and the second by taking a large number of readings (providing the eye does not suffer change meanwhile). The flicker photometer meets the second condition fairly well; and as regards the first, in all cases in this investigation two observers were used, both taking not less than twenty readings apiece upon each setting. The reliability and constancy of the eye is brought out to some extent in the following paragraphs, and a résumé of physiological optics is given to recall the reasons for the same.

The field of commercial illumination possesses some interesting characteristics. No rigorous photometrical system will yield all the information the illuminating engineer will desire to know. In general, efficiency, physical comfort and artistic effects are usually to be allied, if not inseparable. But it does not follow that a source to illuminate a dwelling room will be a good one to read by, or to reveal fine detail. The first case demands delicate shades of color in esthetic qualities, hence we use warm and soft colors. In the particular case demanding brightness only, the solution is to produce the efficient yellow light of the spectrum—do not waste energy in deep red and violet components, which add but little to the total luminosity. Further, the engineer wishes to know what colors are seen best and farthest for signal lights; what ones penetrate a fog best, and similar questions. Hence we can realize the importance of reliable data regarding the photometry of colored illuminants.

Most investigations to date have been done with special apparatus, such as the spectro-photometer, etc., and for many purposes are of little practical result. The investigators here attempted to use only such apparatus as would be available in any laboratory, and to make such determinations as would bear directly upon the subject. Two types of photometers were made use of viz., the Lummer-Brodhun and the flicker. (See Figs. 1 and 2.) The principles of operation of these types were studied and the claims made for them investigated. Such statements as that of the flicker photometer being equally adaptable to measurements of any color, and of its having no appreciable Purkinge effects, were put to test. The agreement of the flicker with the Lummer-Brodhun photometer on various colored illuminants was also investigated, as following up the results of Lauriol, Wild, and others. Some of the physiological conditons affecting the accuracy of photometric readings could be only touched upon, such as the distance of the eye from the screen, the best intensity of illumination, the portion of the

retina upon which the image falls, the rapidity of flicker for most accurate readings, and kindred topics. Finally an attempt was made to determine the ratio of brightness of different colored lights when at different intensities, aiming towards a definite measure of the changes.

The sources for the production of the colored lights were various incandescent lamps such as may be obtained on the market. These were clear carbons and tungstens and carbons with ruby-red, signal-green, and cobalt-blue glass. No dipped lamps were used. These lamps ranged from four to sixteen candle power.

Comparisons of Horizontal Distribution.

As pointed out above, there has arisen a question concerning the agreements of the two types of photometers used in this work. An attempt was made to bring out this point by means of polar distribution in a horizontal plane.

A set of such curves was made upon a 16 candle-power, 115 volt Packard No. 1 incandescent lamp by both the Lummer-Brodhun and the flicker photometers. This white lamp was compared with a secondary calibrated white standard, sixteen candle-power at 111.2 volts. Both lamps were maintained at their respective voltages throughout. The standard lamp was kept in its primary position, while the one to be compared was rotated about a vertical axis, and a set of readings taken at every twenty degrees. On each setting three direct and three reverse readings were taken by the Lummer-Brodhun, and three by the flicker photometer. These readings were averaged, thus obtaining a mean reading of each instrument for each angle. From these the candle-power points on each angle were computed, and the accompanying distribution curves plotted. (Fig. 3.)

These curves have the form that would be expected, viz., are of general circular contour, flattened slightly on the sides where the minimum area of filament is exposed. The outline is fairly smooth, with exceptions of points on angles of 60 and 340 degrees, where slight peaks occur. These may be due to either the shape of the filament or to the quality of glass through which the light at these angles

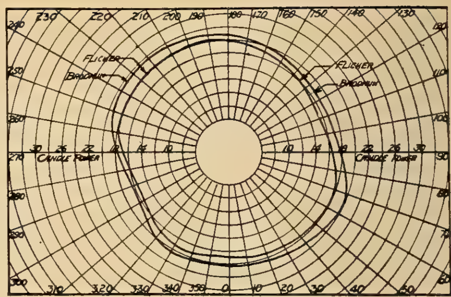


FIG. 3.—HORIZONTAL DISTRIBUTION, NO. 1 CLEAR CARBON LAMP, RATED 16 C.-P., 115 VOLTS.

must penetrate; that is to say, the absorption of the bulb might be less at these angles. Irregularities were not due to voltage variations, since the readings were taken at different times. The noteworthy point brought out is the fact that all readings on the flicker instrument were lower than corresponding ones for the Lummer-Brodhun screen. Bearing in mind that this is a comparison of nearly white and similar sources, we have a fair proof of the primary non-agreement of these particular instruments. The range of candle-power is from 15.2 minimum to 19.8 maximum, with a mean value for the flicker photometer of 17.03, and for the Lummer-Brodhun of 18.06; an error in difference of 5.53 per cent. Such a large discrepancy argues for the need of a careful and frequent calibration of all photometrical instruments in constant commercial use, for there is no reason to suppose that these particular instruments were better or worse than the average.

This test was similiarly conducted as the previous one. The same method was followed, with the difference that in this case the No. 1 white lamp was replaced by No. 2 signal-green, rated sixteen candle-power at 115 volts. The curves are more irregular than those for the white lamps, due in great measure to the difficulty of judging a sharp setting on account of the colored sight fields. In both photometers the white parts of the screen appear as orange tinted, and the green parts (i. e., turned towards the green source) a light or dark green. These curves (Fig. 4) show a flattening on opposite sides similar to the previous ones, due largely to the filament shape. It appears that there is

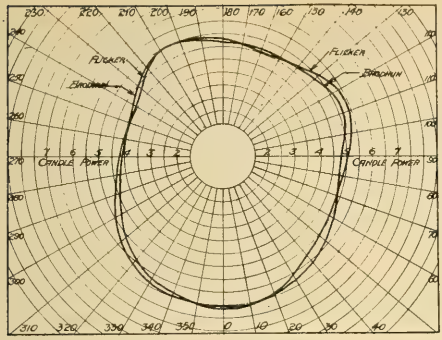


FIG. 4.—HORIZONTAL DISTRIBUTION, NO. 2 SIGNAL GREEN LAMP, RATED 16 C.-P., 115 VOLTS.

a slight tendency to read in favor of the green lamp with the duration of the test, but this effect can not be vouched for absolutely. It would not be improbable, however, in view of a similar effect that the observers have noted in testing of red sources, but in the opposite sense, since the tendency with the red light was to decrease in the value of the red readings with duration. The complementary colors of red and green might bear out this deduction. Admittedly these points are deserving of further consideration.

The candle-power results show the unreliability of the lamp labels, since a sixteen candle-power (labeled) proved to give under test a maximum value of 6.3 candle-power. The minimum value was 4 candle-power, and the average for the flicker was 5.04, compared with 5.09 for the Lummer-Brodhun, a percentage error of .98 per cent. As in test "A," the former is less than the latter, but has not so marked a difference. The general agreement of both curves indicates that for measuring colored lights not more widely at variance than green and white, the two photometers are equally as accurate.

The third test was made to obtain the curves of No. 3 cobalt-blue incandescent lamp, rated eight candle-power at 115 volts. This was compared to a four candle-power white standard, as was the No. 2 lamp. The marked irregularities in these curves (Fig. 5) show the difficulties in comparing blue to white illuminants, as more pronounced than in comparing green to white. However, one chief reason for this was the condition of weaker illumination, making accurate settings more difficult to judge. In this set of curves it becomes apparent that the results from the flicker instrument are more regular than those from the Lummer-Brodhun—an argument in favor of the use of the former for heterochrome work of sharply contrasting colors. The maximum candle-power here obtained was .80, and a minimum of .49. The average of the horizontal readings of the flicker was .585, and that of the other screen .612—a percentage error of 4.42 per cent.

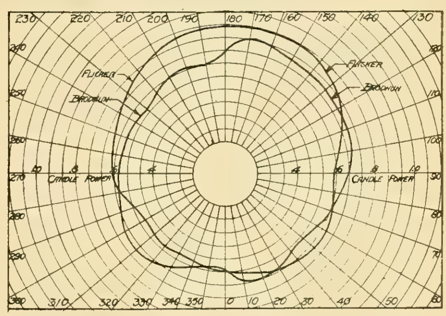


FIG. 5.—HORIZONTAL DISTRIBUTION, NO. 3 COBALT BLUE LAMP, RATED 8 C.-P., 115 VOLTS.

(*To be continued.*)

The Future Light

Prophesies, Safe and Unsafe

The *Scientific American* of April 15 is devoted largely to articles treating of light and illumination. Among these is an article on "Inventing the Light of the Future."

The field of science affords a limitless vista for prophetic vision, and we condone many flights of the imagination in such cases that would be quite out of place in more serious discussions. The writer of the article in this case tangles himself up in the ambiguities of the meaning of the word "light." "What we call 'light,'" he says, "does not exist in the universe apart from eyes that see it," and then proceeds with a somewhat poetic explanation of the statement. The word light has two distinct meanings, one referring to the impression produced upon the visual apparatus and the other to the physical cause of this impression. Light, in its physical sense, unquestionably existed millions of years before there was a human eye to receive it, and, moreover, existed with all its varying wave lengths which produce the sensations called "color." This, to be sure, is not a grave error, but it is just as well to keep within the bounds of attainable accuracy when writing on scientific subjects, even though such articles are intended only for popular consumption. The poet's license does not permit him to practice on technical cases.

The following statements are more seriously in error.

"Green is the most efficient light because the yellow-green portion of the spectrum is most intense. Curiously enough, the greenish mercury arc is one of the most efficient lights that man has produced. Hence, science and engineering have approved the fire-fly's choice of color in getting efficiency."

"Green is the most efficient light because the yellow-green portion of the spectrum is most intense": this apparent explanation analyzed amounts only to this: "Green is the most efficient light because it is most efficient." Green is not the most efficient light; the most efficient light is yellow, slightly tinted with green, which is exactly that of the fire-fly. And the reason for this is that light of this particular wave length, which is the physical definition of color, most powerfully excites the optic nerve. In the physical sense greenish-yellow light is not as "intense" as red light. After having stated that green is the most efficient, the writer, in the next breath, says that "curiously enough the greenish mercury arc is one of the most efficient lights that man has produced." Is there anything particularly "curious" about a fact that is so easily explained?

Continuing the subject, the writer says:

"The physiologist would object to any slavish imitation of the fire-fly on the score that a yellow-green light, however efficient, would be injurious and would distort color values. The physiologist would protest against the use of a greenish-yellow light of 96 per cent. efficiency, and insist upon the employment of a certain amount of red rays."

A bluish-green light of the mercury vapor arc, or Cooper-Hewitt lamp, as it is better known in this country, which contains practically no red rays, is used without protest by thousands of workers in various industries and of all degrees of skill, not only in this country but in Europe; far from protesting against either its color or its effect upon the eyes, they have even been so pleased with the illumination furnished as to threaten strike if the lamps were removed, and in some cases, where particularly close eye work is required, expert operatives have declared that they preferred such light even to daylight.

"The Eye as the Ultimate Judge."

A subheading of the article in question is, "The Eye as the Ultimate Judge." Physiologists as a rule know little or nothing about the effect of different kinds of light upon the eye, but the "ultimate judges," which number thousands, have certainly raised no objection, at least so far as physiological effect upon the organs of vision is concerned, to the bluish-green light of the mercury vapor lamp.

Speaking of photometers, the writer presents this astonishing piece of information: "The newest of these measuring instruments is the 'flicker' photometer!" Will the shade of Professor Rood rise up in defense of his splendid work with this form of photometer of a quarter of a century or more ago?

"The nearly perfect light of the future," continues our prophet, "will be produced in accordance with principles discovered by pure science in laboratories founded with no commercial end in view." This would seem, offhand, a very safe prediction; as a matter of fact it is a most hazardous one. The "nearly perfect light" is quite as likely to be discovered by some unheard of amateur, working, perhaps, in a "home-made" laboratory, and innocent of the work done by all the endowed laboratories of the world. Discovery is partially accidental, but mostly a stroke of genius; and genius has a most exasperating way of eluding conspicuous institutions and expensive endowments. The story of the unsophisticated experimenter who did not even know enough about a thing to know that it "couldn't be done," and has therefore set about and done it, is an old familiar tale.

When Welsbach was a student in Bunsen's laboratory (which might fairly be called a laboratory of "pure science") he conceived the idea of the incandescent gas mantle which revolutionized gas lighting and set forth his ideas to his master. The usual "can't be done" was the prompt reply, at which the undaunted Welsbach, with the true spirit of the genius, forthwith pursued his idea until it was an accomplished fact.

Professor Lovering, of Harvard College, and at one time president of the American Association for the Advancement of Science, demonstrated to his classes by methods of "pure science" the utter impossibility of telegraphing under an ocean 3000 miles wide.

The true theory of the nature of light, which is entirely different from the theory proposed by the great Newton, which has made possible the wonderful advances in the pure science of the subject, was worked out by an obscure London physician; and we might go on enumerating similar cases for pages.

Necessity for a Better Understanding of the Effects of Light on the Eye.

That there is necessity for a better understanding of the effect of various kinds of *illumination*—which, let it be noted, is an entirely different thing from different kinds of *light*—upon the visual organs, there is not the slightest doubt; but this is a matter that cannot be determined in any laboratory, with or without a commercial foundation, but must be the result of numerous and long continued observations upon actual cases of eye-work under the different kinds of illumination provided.

The nature of daylight, the unquestioned standard of illumination, is already fully known, and the physical characteristics of any artificial light are equally susceptible of exact analysis. The light of the future, i. e., the future light-source, will be one whose light approximates "average" daylight in its composition, and which can be operated more cheaply than by any of our present sources. The matter of utilizing the light from such a source to produce an illumination that

shall be safe and hygienic for the eyes is a problem for the oculist and illuminating engineer to work out, and is no very difficult task even in our present state of knowledge. If the best use possible were made of our present light-sources there would be extremely little opportunity for criticism either on the part of "pure scientists" or practical users.

What we most stand in need of at the present time is a more general knowledge of the methods of making proper *use* of light, freed, as the writer of the article in question so frequently insists, from all commercial bias. This latter factor is a greater handicap to rational methods of illumination than the theoretical difficulties in the way of producing perfect light. As the case stands, there are a large number of different light-sources and accessories, each backed by a commercial interest intent upon producing dividends. The maker of the light-source giving absolute daylight color value can see only ocular injury and calamity in the use of light of any other color, however produced; while the makers of light-sources having distinct color values make out just as clear a case for the superiority of light of their particular color to ordinary white light. The makers of reflectors discredit the advantages of generally diffused illumination, while those making apparatus for indirect illumination—which most nearly approaches daylight in the quality of diffusion—just as vigorously point out the evils of special lighting: and so on to the end of the chapter.

Fortunately an association has been formed, with provisions for keeping it rigidly independent of all special or commercial interests, and which, therefore, will be in a position to consider the whole subject on its merits. This will be, perhaps, the greatest work of the American Association for the Conservation of Vision.

Meanwhile, let it be understood that the artificial sun will never be produced. We shall have to approximate daylight by intelligent methods of *using* artificial light rather than by inventing new sources. Our present light-sources and accessories, used with unbiased knowledge, are quite capable of producing a condition of illumination which, to all intents and purposes, is the equal of daylight.

Let no one misunderstand us, however, purposely or otherwise. Research in pure science is always and everywhere a commendable thing, and the fact that a commercial organization is supporting a laboratory for research work is a most notable and eloquent testimonial to the value of pure science. We are not taking issue with the laboratory referred to and its exceptionally able corps of investigators. We are only attempting to correct some technical errors in a popular treatment of a scientific subject.

Scientific Management

"Scientific management," or "efficiency engineering," has apparently been making somewhat more rapid progress of late. The *Engineering Magazine* for April gives special attention to the subject in a number of articles by prominent specialists in this new science. From the theoretical standpoint the question of studying the human motions necessary in performing any given work with the purpose of reducing them to their simplest form would seem self-evident. The proposition, however, is by no means universally accepted as yet; organized labor has entered more or less vigorous protests against the system on the ground that it is a method of speeding up the operative to his last limit, and there are some manufacturing plants in which the system has been introduced and afterward abandoned. This latter, however, does not necessarily argue failure of the principles of the system, but only imperfection in special cases of its application.

In all the writings of the "efficiency engineers" and "shop scientists" that we have examined thus far, there is complete absence of the slightest mention of *illumination* as a condition of human efficiency. Perhaps the consideration of this fundamental facility is not considered within the province of the efficiency engineer, and is therefore unmentioned out of respect to professional ethics. On general principles, however, it would seem that an expert who obtains a fee for telling his client how to get more and better work from his operatives is in duty bound

to at least call attention to every condition contributory to this end; and certainly illumination is one of the most important of such conditions.

There is still another possible reason for this omission, and that is a lack of knowledge on the subject by the scientific managers themselves. No matter how systematic the motions of an employee may be, or how completely unnecessary action has been eliminated, unless there is easy and perfect vision the net results of the motions will be reduced in effectiveness.

Efficiency engineers have rightly considered the mental attitude of the operative as a matter of much importance. Light not only affects the actual results of the motions of the operative, but both his psychological and physiological condition. An efficiency engineer who would find a factory distinctly unsanitary would doubtless insist upon the removal of this handicap. Although it is not yet hardly suspected, the fact is nevertheless true that the most unsanitary condition that can prevail in a workshop or factory is bad illumination. Is it not time that this fact were made the subject of the same exhaustive scientific analysis and observation as the number of motions required to perform a certain operation? If we are to have efficiency let us not stop half-way but have all there is in it.

The Development of Light Sources

That we are still in the period of transition in the development of methods of producing artificial light is apparent in many different directions. The older light-sources not only persist, but continue to increase in number; while the newer sources, though making steady gains, still show a certain hesitancy and lack of confidence in themselves which is characteristic of adolescence.

The tungsten lamp achieved immediate notoriety by reason of its enormously increased efficiency, but this great advantage was handicapped by fragility, uncertainty of life, and much greater cost. At the outset the overcoming of these difficulties seemed to be a physical impossibility; it necessitated making an inherently brittle substance tough. But chemistry, like the science of medicine, has had to "about face" many times in its career. The classification of tantalum among the non-malleable and non-ductile metals was discovered to be an error based upon ignorance of the nature of the metal in its pure state, in which condition it proved to be highly ductile. Later, similar investigations showed the same to hold true with tungsten. The word "pure" has a very different meaning to the chemist from what it has to the layman, or even to the pure food inspector. Mr. John A. Brashear, the greatest instrument-maker of modern times, was once asked by a manufacturer to make "a perfectly straight glass bar three feet long." With his customary business sagacity, the manufacturer took the precaution of asking for an estimate of cost before the work was done; to which Mr. Brashear replied that, while he could not guarantee absolute accuracy, he would do the best he could to produce such a bar for $200,000. This naturally led to a further discussion of the word "perfect," which resulted in the manufacturer amending his specifications to such an extent that the bar which answered all his requirements cost some $40. If a chemist were asked to prepare a pound, or perhaps even an ounce, of perfectly pure tungsten it is doubtful if he could fill the order at the figure set for the perfectly straight bar. Physical or chemical perfection is what the psychologists call a concept, like the mathematician's point and line, and is as impossible of achievement by human means as to ascend to heaven by a ladder.

The closeness with which modern science approximates to ideal perfection, however, is the marvel of the present age. The preparation of tungsten sufficiently pure to render it ductile seems to be just balancing on the edge of commercial success. Lamps using filaments of drawn tungsten wire have been regularly offered for sale, but as yet their production is limited and uncertain. When once the possibility of producing a physical result has been demonstrated, however, it is a safe prophecy that the means of reproducing it on a commercial scale, provided there is a sufficient commercial demand, are not far distant.

But while we are waiting on the border-

land of the drawn wire tungsten lamp there are rumors that the possibilities of carbon as a filament material have in no wise been exhausted, and that it may again take its old place of leadership, in spite of the progress of its recent rival. Carbon is a mysterious substance, and when we find out all about its peculiarities, physical and chemical, there will perhaps be little more to know about organic and inorganic chemistry. Theoretically, carbon is the better filament material; and again the prophesy is fairly safe that the theoretically preferable will in the end become practically the most useful. This much seems certain: that the final form of the incandescent electric lamp using a solid radiant has not yet arrived.

The arc lamp is in a still more transitory state. The old time carbon arc, which held its place side by side with the carbon incandescent, seems destined to extinction, not so much, perhaps, from rival arcs as from incandescent sources. The flaming arc would seem to be the prototype to the final form of arc lamp, the arc lamp being understood as using an arc between solid electrodes. This prophecy is based upon the greater efficiency of gases and vapors as light radiators. Both theory and practice would seem to indicate that the flaming arc in its final form will possess a means of confining the vapors, and thus conserving the heat energy as well as the mechanical stability of the electrodes.

The mercury vapor lamp, which has already demonstrated the practicability of the use of luminous vapors, is undoubtedly also on the eve of a great extension of its field of usefulness through the form known as the quartz lamp.

So rapid have been the improvements in the production of light from electric energy within the past few years that users show a certain disinclination to make changes, fearing that the present sources may become antiquated long before they have lived their natural life. This is a kind of conservatism, however, that may very easily outrun true economy. To decline to take advantage of so marked an improvement on account of the expectation of soon finding a greater improvement savors too strongly of the immigrant who declined to pick up a dime that he happened to see on the sidewalk, believing that he would pick up dollars when he "got up to Gold street." To prophesy that better things will come is an easy prophesy; to say just when they will come is quite another matter. Science often pursues a will-o'-the-wisp which, just as it is seemingly within the net, fades away only to appear in a still more attractive form just out of reach.

The benefit to be derived from improved illumination are so great in proportion to their cost that, to neglect taking advantage of them in the hope of something better is at best a very hazardous risk. Life is too short, and far too precious, to spend in waiting. The greater wisdom is to carefully balance the cost against the advantages, and see how long it will take for the latter to overtake the former.

The Fixture Trade—East and West

In our general review of the year's progress in the March issue we reported the fixture business of the country as being in a very unsatisfactory condition. A more careful survey of the field recently leads us to modify this sweeping statement. The evidences of prosperity among Western manufacturers are many and unmistakable. An established business may continue to run along the boundary line between profit and loss for some time, without any external indications of its precarious condition, but a manufacturing business that is continually requiring additional space, facilities and workmen must necessarily be expanding and progressing, and this is the condition of the majority of the Western manufacturers.

A number of explanations might be given to account for these facts, all of which would probably contain some measure of truth. The long succession of abundant crops has given the Western farmer a continued era of prosperity, and this has naturally spread out to the tradesmen and others in the towns, who are directly dependent upon the farmer's patronage. The West has undoubtedly enjoyed more general prosperity since the last financial upheaval than the East.

The Western fixture manufacturer has

evidently not been slow to take advantage of circumstances, and has adapted his wares and his methods of doing business to the conditions of trade as they arose. He has catered to the wares of the great middle class, which always represents the largest sum total of purchasing power. Where there is one monumental public building erected there are 10,000 average dwellings put up, to say nothing of the smaller stores and hotels.

Again, the Western manufacturer has been more ready to break away from traditional designs and ideas, and to take up modern practices in illumination and improvements in light-sources. The larger part of the real interest and energy shown in the effort to organize the fixture trade is likewise due to the West.

The means of producing light are being rapidly revolutionized—in fact, have already been revolutionized to a large extent, and it is inevitable that this revolution must extend throughout every branch of the lighting industry, including fixture design and manufacture. Those who are first to jump overboard from a sinking ship are likely to find the best planks and to stand the best chance of getting to shore. The Western fixture manufacturers have shown the most courage, as well as the best directed efforts in the transition from the old *régime* to the new.

Indirect Lighting With Gas

An interesting discussion of this problem has taken place in the *Electrical World,* as noted in the Review Department of this issue. Mr. Albert Scheible, in an article on " Gas Lamps vs. Indirect Lighting," tells why this method of illumination can never be successfully accomplished by gas, and then calls the attention of his electrical confreres to the value of this alleged handicap on gas in furthering the use of electric light. Mr. Scheible's objections, which he claims are insurmountable, to indirect lighting by gas, are: the blackening of the ceiling by air currents; the difficulty of lighting and extinguishing the burners; and the impossibility of using a highly efficient reflector on account of the heat.

The first of these objections is very readily overcome by using a ceiling plate of some indestructible material, such as opal glass or enameled steel, that can be easily cleaned by simply wiping off with a cloth. This is the method used in the new office building of the People's Gas Light & Coke Company of Chicago. The second difficulty is readily overcome by the use of pilot flames, or electric control. The additional cost of pilot flames is by no means minimized by Mr. Scheible. In his reply to the article, Mr. Norman Macbeth gives the cost of pilot flames from actual meter measurement as five cents per month, which is certainly not a very serious matter.

To make a silvered glass reflector that will withstand the heat to which it is subjected in use with a mantle burner is by no means an impossibility.

Thus, the fatal objections to indirect lighting with gas as set forth by Mr. Scheible are, in the words of the lamented Mark Twain, " much exaggerated." The use of a ceiling plate—those designed by Mr. Ryan for indirect lighting with electric arcs would answer very well—and the common by-pass system now in general use, and a silvered reflector made by processes now in regular use, would make indirect lighting with gas quite as feasible as by electric light.

There is no escaping the fact, whatever one's personal interests or prejudices may be, that indirect lighting has been very rapidly gaining in favor within the past year. Several of the best known fixture manufacturers of this city are putting themselves in shape to supply fixtures and demonstrate their use, and the number and variety of recent installations speaks equally well of its growth.

One of the great objections urged against indirect lighting in the past has been its higher cost, or, as the engineers prefer to put it, its lower efficiency. Efficiency being measured only in terms of " intensity on the working plane," this method of lighting of course suffers by comparison with direct methods; but such a measurement omits two very important factors: first, the fact that the eye does not require as high an intensity, in fact, prefers a lower one in highly diffused light, as is clearly shown in the case of daylight; and second, that the efficiency of the eye so far outweighs any question of cost of illuminant

that the latter must be considered only after the former has been fully provided for.

The physical inefficiency of indirect lighting, however, is one of the conditions which particularly suggests the use of gas, which admittedly stands higher in this respect under ordinary conditions than electric light. Whether the gas interests will allow this rapidly developing method of illumination to be taken entirely by default by the electric interests, of course, remains to be seen. It is a rather significant fact that not a word of rebuttal argument to Mr. Scheible's article, or even mention of it, has thus far appeared in the gas journals of this country. This is the more significant for the reason that the whole purpose of Mr. Scheible's article is to furnish a talking point against gas light to the electric lighting interests.

We believe that indirect lighting furnishes one of the most attractive fields at the present time for gas illumination. Will the gas interests avail themselves of the opportunity, or will they continue to retreat before the steady and vigilant attacks of the electric light?

Letters

Editor The Illuminating Engineer,
New York City:

Replying to Mr. Codman's remarks in your April issue I would state that I furnished for my article as complete and accurate data upon the subject in question as my experience and training will allow. But allow me to state that the measurements were taken by the best instrument on the market, which was calibrated and checked to a reasonable degree of accuracy, and I again state that with a variation of .15 foot-candles with an average illumination of 2.8 foot-candles, the variation is perceptible to the eye, which places this particular installation beyond criticism, inasmuch as the desired effects were obtained and the installation has passed beyond the "smashing point," to which so many indirect lighting installations are subject, after the novelty has worn off.

Yours very truly,
W. S. Kilmer.

Editor The Illuminating Engineer,
New York City:

I wish to make the following corrections in my article appearing in your March issue, entitled "The Lighting of a Large Power House." On page 31, in the summary, there is an error, due to the figures for the engine house and the figures for the total having been interchanged.

The figures for the engine house summary are as follows:

		Per Lamp		Total	Total
Lamps.	Volts.	Watts.	C. P.	K. W.	C. P.
4 H 20 HH.	250	438	600	13,125	18,000

Under the heading of total, the total K. W. should be 24.5 and the total C. P. 33,750.

Also under the heading of maintenance on tubes per year in boiler room and south basement, the total renewals should be 135, instead of 158, which would make the cost per 1000 hours 66 cents, instead of 76 cents. Yours very truly,

William W. Evans.

Editor The Illuminating Engineer,
New York City:

No feature of the development of lighting has been more noticeable than the interest and intelligence displayed by the public in general in the advances that have been made.

During the past year the public has come to accept, without question, the new units and systems of lighting, and does not hesitate to adopt such systems and units as are recommended.

We believe that this has been brought about by careful attention given by the manufacturers in providing different parts of lighting units suitable for various purposes, and in the care we have exercised in recommending such units as are best adapted for each particular case. It is our experience that the public in general is only too ready to accept anything we have to offer which is of proven worth. We have found this true in every electric consuming device or appliance, and the progress which we make depends upon the extent to which we can educate our customers electrically.

During 1910 we added 1480 custom-

ers to our circuits, making a total of 12,119 customers January 1, 1911. Our population is 75,000, or we have nearly one electric customer for every six residents.

Probably one thing during the past year that has resulted in the most general satisfaction and brought about the most satisfactory results is the bringing about of more pleasant relationship between ourselves and our customers. We have been instrumental in doing this by endeavoring to forget that we are a corporation dealing with the public and adopting associations and business relationships which exist between the ordinary merchant and his customers.

Through the medium of our sales and display rooms we have been able to keep our customers in touch constantly with the progress made in electric appliances of all descriptions, and have kept in touch with different classes of customers through our representatives especially prepared for the different lines of work, and made it our business to see that the customer is treated with fairness in every respect, and that when he paid his good money he received the greatest possible value for it.

This principle carried out in giving the customer the very best lighting system which we could recommend, considering not only his needs, but also his pocket book, the same system applied to the large power customer or the housewife with the electric iron, has resulted in the percentage of increase of new business for the year being most satisfactory, and leaves only the brightest prospects for the coming year.

W. A. Wadsworth,
Sales Manager, Schenectady Illuminating Company, Schenectady, N. Y.

Notes and Comments

More and Better Light

A View of the Situation as Sketched by the Daily Press

PHILADELPHIA BEST LIGHTED OF CITIES.

Chief McLaughlin Presents Figures Showing Supremacy of Electric Plants.

Philadelphia is possibly the best lighted municipality in the world. In support of this fact Chief McLaughlin, of the Electrical Bureau, furnishes some startling figures in his current annual report, showing the overwhelming preponderance of powerful arc lamps maintained by this municipality for street lighting as compared with the principal European cities.

No other city in this country, the Chief declares, can approach the completeness and effectiveness of Philadelphia's electric street lighting, which is to be greatly extended this year. As a concrete demonstration of this fact, Chief McLaughlin furnishes the following table of the number of street arc lights maintained by different municipalities as compared with Philadelphia:

City.	No. lights.	Candle power.
Philadelphia	13,285	2000 each
New York (Manhattan and Bronx)	5,500	1200 each
Berlin	1,055	2000 each
Paris	1,851	....
Vienna	1,155	1700 each
London	400	1200 each
Brussels	210	....

During 1910, also, Chief McLaughlin points out, that there were established 986 new arc lights in this city, or almost as many as the entire equipment of Berlin or Vienna, twice as many as London possesses, one-half of the entire number of lights in Paris and 50 per cent. more than London and Brussels combined.—*Public Ledger.*

PLAN BRIGHTER CITY.

Project Being Discussed by the Commissioners.

Begin With "the Avenue."
Double Row of Arc Lamps in Middle of the Roadway.
Isles of Safety Provided.
Illuminating Globes Will Be at Least 23 Feet in Height—Commission of Fine Arts Consulted.

To make Pennsylvania Avenue a brilliantly lighted thoroughfare from the Treasury to the Capitol, by the installation of an entirely new system of electric arcs mounted on ornamental posts placed on "isles of safety" in a double row in the middle of the street, is outlined in a proposition sent by the District Commissioners to-day to the Commission of Fine Arts, which body is asked for advice on the subject. Promise is made that as soon as the art experts have

passed on the details of the proposition the Commissioners will get to work to start legislation for the new lighting proposition, which will be but a detail of the vast plan now being discussed by the Commissioners for a city as nearly bright by night as by day.

The plan has been worked out by Electrical Engineer W. C. Allen. In the papers which were sent to-day to the Commission of Fine Arts were photographs of details of street lighting schemes from European cities. The feature of the foreign arc lamps is the highly artistic manner in which they are mounted on massive metal columns. The scheme as planned by Mr. Allen calls for metal work of a high grade on the electric light poles.

The cost of the proposition is figured at $20,280 for installation and $7,996.20 a year for maintenance, being an increase of only $2,356.20 a year over the cost at present.—*Evening Star.*

MORE LIGHT

Main Street merchants have seen a new light. They have decided to supply themselves with sufficient electric fluid, without the aid of the lighting company, to continue the proud boast that their stores are on the "White Way" of Yonkers.

Their decision is not based on a desire to compete with company. But the company having materially raised the rate given them the first year, they very naturally looked about to prevent this raid on their treasury.

They are too progressive to go backward by abandoning their lighting scheme. They do not understand why the value of lamps should jump from $800 to $1200 a year—now that the Democrats have guaranteed to decrease the cost of living. So they will make artificial sunshine themselves.

If their experiment pans out on the financial side, maybe small communities of apartment dwellers will see a way to follow their example. There certainly will remain the temptation to do so so long as Yonkers has to pay more than Mount Vernon.—*Editorial in the News.*

MORE LIGHT IS DEMANDED BY CITY BUSINESS MEN.

Complaint That Binghamton Is a Long Time Getting Interested in Boulevard Lighting.

That the question of boulevard lighting for the business streets is soon to become an important issue was made certain at the dinner of the Merchants' and Advertisers' Association in the Y. M. C. A. Building. At that time expressions from the leading business men of the city, the commercial organization which are promoting the interests of Binghamton and representatives of the newspapers indicated that the project has a strong backing.

To merge the proposition of a municipal lighting plant with that of the boulevard lighting system is one of the plans discussed. With the question of improving the lights along the business streets of Binghamton comes the question as to where that light shall come from and by whom it will be furnished.

At the meeting it was said that other cities have eventually assumed the ownership of the boulevard lighting system if they did not do so from the start. Elmira was cited for an example. In that city the merchants installed the system, then they called upon the municipality to buy it over and run it, which was done.—*Binghamton, N. Y., Binghamtonian.*

TO INSTALL ELECTROLIERS.

Six Blocks More To Be Put In at Mason City.

Standards for Clusters Will Be Made by Home Iron Plant—Many Streets Improved.

Mason City, Iowa.—April 6.—Special: Six blocks more of cluster lights were ordered in to-day by the City Council and Board of Supervisors in compliance with the campaign for more lights inaugurated by the Commercial Club. Each electrolier has a cluster of five lamps and costs about $82.—*San Francisco Call.*

WILL DISCUSS LIGHTS AND NEW FACTORY.

Mass Meeting at Commercial Club To-Night to Take Action on Important Matters.

A mass meeting of business men, city officials and all citizens interested in the welfare of Council Bluffs has been called for this evening at the rooms of the Commercial Club for the purpose of discussing the proposed plan of curb lights for the principal business streets, and also to determine what support the city will give to a manufacturing concern that is considering locating a factory in this city.—*Omaha World-Record.*

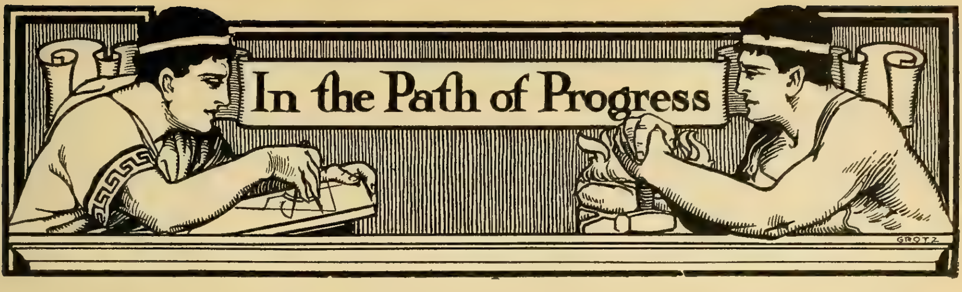
WILL EXTEND ELECTROLIERS.

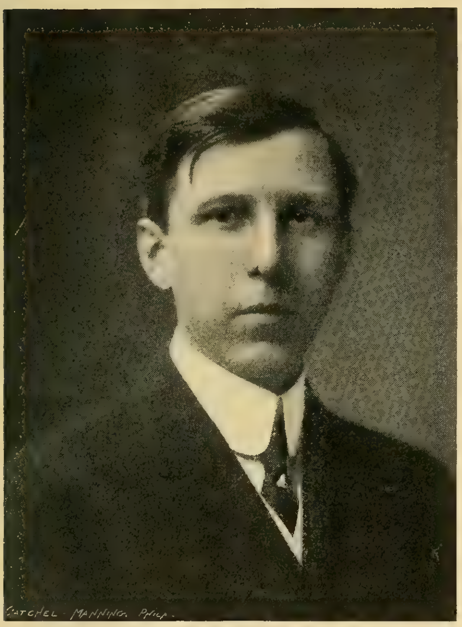
East Des Moines Plans a Bigger "White Way."

Will Light East Fifth From Walnut to Rock Island Tracks and Will Complete Loop.

East Des Moines boosters are working to have the "White Way" lights in East Des Moines extended eleven blocks.

The lighting of East Fifth Street north from the Rock Island tracks, it is believed, will cause more travelers to leave the trains at the east side stations. There are two stations, the Rock Island and the Great Western, which is also used by the Short Line, that mark the southern limit of the lights as proposed.—*Springfield, Ill., Register.*





NORMAN MACBETH.

Mr. Norman Macbeth Becomes Illuminating Engineer for Westinghouse Interests

Mr. Norman Macbeth, who for the past two years has been in charge of the Illuminating Engineering Laboratories of the Welsbach Company, Gloucester, New Jersey, has resigned that position to become the illuminating engineer jointly of the Westinghouse Lamp Company of Bloomfield, New Jersey, and the Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pa. He will enter upon his new duties May 1.

Mr. Macbeth has already established a reputation in both the practical and theoretical departments of illuminating engineering, which places him among the few thoroughly competent, all-around illuminating engineers in this country. His work in connection with the Welsbach Company extended to the entire gas lighting industry, and undoubtedly did more to create an interest in and sentiment for the use of illuminating engineering in connection with gas lighting than any other single influence.

The question is frequently asked of one who has amassed wealth in an unduly short period of time, "Where did he get it?" If such a question is pertinent in the case of wealth it must be worth while asking of one who has achieved a notable success in any particular line or calling in an equally short period, "How did he do it?" A brief review of Mr. Macbeth's work may therefore be of interest, and possibly of inspiration and encouragement, to others.

Mr. Macbeth was born in Stayner, Ontario, Canada, in September, 1873, and is therefore not yet thirty-eight years old. His school training was received in various parts of Canada and the United States. He is not a graduate from technical or other college. Referring to this fact he once stated that he had always found it quicker and cheaper to pay for exactly the information he wanted as occasion arose, being always able to secure the desired instruction from specialists in the particular branch. He is blessed with the faculty of concentration and sustained effort to a marked degree, which generally has to be acquired by a long process of mental discipline, which occupies a good part of college life, and has thus been able to select and acquire from all available sources the particular knowledge and information which he found necessary or useful for the work which he had in hand.

From 1890 to 1897 he was engaged in the practical work of installing gas and electric equipment in buildings in the last year, giving part of his time to the manufacture of aluminum reflectors of his own design for show-window lighting with gas lamps.

From 1897 to February, 1909, he acted as a consulting engineer for gas and electric lighting, giving special attention in the former part of this period to the inspection of meters and adjusting accounts. This was the line of work in which there had been a considerable amount of either outright faking or concealed crookedness which had brought the business into bad repute. By reason of his expert knowledge of the subject, his practical turn of mind, and his absolute adherence to sound business ethics, Mr. Macbeth succeeded in establishing for himself even in this difficult field a reputation for ability and probity which not only won friends, but a fair competence for his labor. He has at least one unique distinction, that of being the first independent consulting illuminating engineer to make a comfortable living from his professional services. In the latter part of this period he devoted a portion of his time to constructing illuminating engineering, as well as consulting, in 1908, designing and installing in Philadelphia the first complete installation of tungsten lamps of American manufacture, and also the first complete installation of inverted gas lamps laid out on strictly illuminating engineering lines and described as such in the technical press.

His work with the Welsbach Company began in February, 1909. Since that time he has created a well-equipped department of illuminating engineering, particularly as applied to gas lighting.

On the theoretical side of illuminating engineering Mr. Macbeth has contributed freely to the technical press and to the Proceedings of the Illuminating Engineering Society. Perhaps his greatest contribution to the science of illuminating engineering is the calculator, now known by his name, which is the illuminating engineer's slide rule, and is as useful in making calculations in illumination as the regular slide rule is to the mechanical or civil engineer. He was also the first to work out the "flux-polar diagram" for determining the mean spherical candlepower direct from the polar distribution curve, paper based upon this diagram being now regularly sold.

Dr. Johnson once said that "You could do almost anything with a Scotchman if you caught him young enough." Mr. Macbeth evidently caught himself in time; he possesses the true Scotch shrewdness, keen wit, and sense of fairness and justice. He is a strict positivist, having no sympathy for those who seek to promote their own interests by decrying or belittling the interests of others.

Mr. Macbeth is at present a member of both the American and British Illuminating Engineering Societies; the Franklin Institute; the National Commercial Gas Association, of which he is the chairman of the Committee on Illumination, and illumination editor of the *Association Bulletin;* the American Association for the Conservation of Vision; and associate member of the Michigan Gas Association, and the National Electric Light Association. He was one of the lecturers in the Johns Hopkins University course in illuminating engineering, given under the auspices of the Illuminating Engineering Society, and is also a member of the Canadian Society of Philadelphia.

Another New Diffusing Reflector

Under the trade name "Haskins-Lucida," the Haskins Glass Company, of Wheeling, W. Va., has just offered to the public an attractive line of translucent reflectors. The glass is exceptionally fine in its appearance by both transmitted and reflected light, having a pearly translucency free from visibly large opaque particles. The contour of the reflectors is of good design, and the workmanship excellent. Another choice is thus offered the discriminating illuminating engineer in his efforts to give the most pleasing as well as the most efficient lighting results.

"The Humphrey Arc"

This is the title of a very elaborately gotten up book of 48 pages and cover, describing the various types of this well-known make of gas arc lamp. The results of tests on a five candle outdoor inverted lamp made by the Electrical Testing Laboratories are given.

"The Illumination of the Streets"

Under this title the Holophane Company, Newark, Ohio, has issued a booklet of 16 pages, showing their new combination street lighting reflector. Distribution curves are given together with tables and diagrams giving the requisite data for laying out installations.

Personal

Mr. H. M. Slauson has resigned his position as general sales manager of the Opalux Company, New York, to take effect May 1, from which date he will represent the H. W. Johns-Manville Company, handling their electrical business in the State of New Jersey.

The Smyser-Royer Company are now located at the corner of Eighteenth and Filbert Streets, Philadelphia, having been obliged to seek new quarters through the enlargement of their business in lamp posts, electroliers, etc. The company now occupies an entire building, so as to provide ample opportunities for its various departments, including the studio. They were formerly located at 1506 Sansom Street.

Mr. E. J. Kulas has severed his connection with the Central Station Development Company, Cleveland, Ohio, in order that he may give greater personal attention to other interests with which he is identified. Important developments in connection with the Tungstolier Company of Conneaut, Ohio, of which he is the president, are claiming much of his time, and necessitates his retiring from active association with several other corporations in which he holds office.

National Electric Light Association Convention

It is hardly possible that the announcement of the time and place of this—May 29 to June 2, in the United Engineering Societies Building, New York—can be news to anyone directly or remotely connected with the electric lighting industry.

As the membership of this association now numbers close to 8,000, and will probably pass this mark by the time of the convention, the various committees have taken due care to provide for the greatly increased attendance which is sure to result. That their work has been carried out to the utmost limit of accuracy and care the various announcements already made will indicate; and those who contemplate attending this meeting, which will undoubtedly be a record one, may rest assured that no item or detail however trifling which can in any way conduce to the pleasure or value of the occasion, will be lacking. Only one final word is now in order—COME.

Robert Webb Morgan

Robert Webb Morgan died suddenly of pneumonia on April 17, after an illness of only six days. Mr. Morgan was born at Tarrytown, N. Y., 1864. His father was N. Dennison Morgan, one of the leading financiers of New York of his time, and a founder of the Mutual Life Insurance Company. His mother was a daughter of the late Gen. James Watson Webb, Minister to Brazil. Mr. Morgan was educated at St. Paul's School, Concord, N. H., and later at Garden City, N. Y. Previous to his engaging in the electrical business, he was purchasing agent for the Wagner Palace Car Company. After the consolidation of this company with the Pullman Company, he organized and was president of the Globe Printing Company. In 1901 he established the Anchor Lamp Company, and was its president, and in 1908 the Aetna Lamp Company, of which he was also president. Mr. Morgan lived at Bronxville, N. Y., and was buried at Kensico, N. Y. He leaves a widow. He was a member of the Society of Colonial Wars, and one of the charter members of the Military Order of Foreign Wars of the United States, of which organization he was deputy secretary.

Proceedings of Technical Societies

Illuminating Engineering Society

New York Section.

The April meeting of the New York Section was held on the evening of the thirteenth. Dr. Joseph C. Pole presented a paper on the "Photometry of Mercury Vapor Lamps." The paper is a highly technical discussion relating to the photometry of point and line sources.

Mr. Bassett Jones, Jr., presented a paper on "Polar Curves of Finite Line and Surface Light-Sources." His treatment of the subject was also strictly technical, as indicated by the title.

Mr. O. P. Anderson presented a paper on "Sign Lighting," in which he described signs of various types, and explained the operation of the flashers used for moving and talking signs. Speaking of low voltage sign lamps on high voltage circuits he maintained that tungsten lamps so used should not be flashed less than ten at one time on account of the necessity of the series connection. The papers received a full discussion.

Chicago Section.

A meeting of the Chicago Section was held in the Green Room of the Kuntz-Remmler Restaurant, Chicago, at noon April 20. Chandler R. Gilman of Milwaukee, Wis., chief electrician of the Chicago, Milwaukee & St. Paul Railway Company, read a paper on "Recent Developments in Train and Car Lighting." Discussion was offered by Messrs. Albert Scheible, C. W. Naylor, T. H. Aldrich, M. G. Lloyd, F. A. Vaughn, G. C. Keech, A. J. Sweet, A. M. Wilson and C. R. Gilman.

At the meeting to be held on the evening of May 18, Mr. Charles A. Luther, illuminating engineer of the People's Gas Light & Coke Company, will present a paper on the "Illumination of the People's Gas Building." This meeting will probably be held in that building.

At the June meeting Mr. W. D. Bradley of the American Luxfer Prism Company will read a paper on "Natural Daylight Illumination." This will complete the present season.

New England Section.

The New England Section held a meeting Monday, April 10. A paper on "Modern Gas Illumination" was read by Mr. T. J. Litle, Jr.

At the meeting to be held Monday, May 8, Mr. W. E. Wickenden, assistant professor of electrical engineering in the Massachusetts Institute of Technology, will present a paper.

Philadelphia Section.

A meeting of the Philadelphia Section was held Friday, April 21. Mr. E. C. Crittenden of the Bureau of Standards read a paper, entitled "An Experimental Study of Flame Standards."

The next monthly meeting will be held Friday, May 19. Mr. W. D'A Ryan of the General Electric Company of Schenectady will read a paper, entitled "Mill Lighting." The paper will be supplemented by a series of lantern slides.

CONVENTION OF THE MISSOURI ELECTRICAL ASSOCIATION.

At this convention, which took place in St. Louis, April 13, Mr. W. D'A. Ryan delivered an address on "Illumination and Street Lighting," which was fully illustrated by lantern slides. Mr. Ryan gave a general review of a development of electric street lighting from the earliest forms of arc and incandescent lamps to the most recent improvements. He also discussed

the spectacular lighting as used at the Hudson-Fulton Celebration in New York and at Niagara Falls.

Mr. John F. McGlensey gave a practical talk on "Illuminating Engineering in Connection with the Work of the Union Electric Light & Power Company of St. Louis." The company maintains a department, the services of which are given gratis to builders, architects, and others who are interested.

Mr. M. J. Cunningham read a paper on "Ornamental Street Lighting," in which he discussed the arch, bracket, cluster, and flaming arc systems, dealing particularly with the commercial side of the proposition.

CONVENTION OF THE IOWA ELECTRICAL ASSOCIATION.

This convention was held at Davenport on the nineteenth and twentieth of April. Mr. J. D. A. Cross presented a paper on "Ornamental Curb Illumination." Copies of this paper are not yet received.

CONGRESS OF TECHNOLOGY—MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

As previously announced, this took place in Boston on April 10 and 11. Mr. J. S. Codman presented a paper on the "Advent of Illuminating Engineering." The paper is brief, and refers to the formation of the Illuminating Engineering Society in January, 1906; the publication of THE ILLUMINATING ENGINEER, New York City; *The Illuminating Engineer*, London, and the formation of the English Illuminating Engineering Society as particularly marking the establishment of the science and profession. The organization of the American Association for the Conservation of Vision is noted as the latest step in the progress of the illuminating engineering movement.

Mr. William H. Blood, Jr., presented a paper on "Improvements in Efficiency of Electric Lighting Apparatus and What the Public Gains Thereby." The writer traces out in a very clear and comprehensive manner the improvements that have taken place in the generation and distribution of electric current since this became a commercial enterprise and states that "it has been secured through careful study by educated men applying scientific methods to the working out of definite problems. That some of the results accomplished are almost miraculous we are forced to admit, but that they are haphazard we emphatically deny."

The present tendency in illuminating engineering is thus set forth:

"At the present time, now that illuminating engineering has been placed on a reasonably exact basis, illuminating engineers are concerning themselves more and more with the artistic and physiological sides of the question. The hygienic aspects of illuminating engineering in particular are at the present time obtaining steadily increasing attention, and the work along these lines in regard to school houses and industrial plants is conspicuous."

NATIONAL ASSOCIATION OF COTTON MANUFACTURERS.

The annual meeting of this association took place in Boston, April 12 and 13. Mr. J. S. Codman presented a paper on "Standardization of Artificial Illumination in Cotton Mills." The author calls attention to the wide diversity of methods in illumination prevailing in textile mills, and then proceeds to a close analytical study of conditions, followed by various tabulations and formulae for use in arriving at the best methods of illumination. The treatment of the subject is on a distinctly scientific basis.

The author's views as to the size of units most suitable for weaving rooms is of interest:

"Referring once again to the question of using a large number of low power lamps, or a small number of high power lamps, it appears from above discussion that if we are going to get satisfactory illumination the spacing should not be greater than is shown in Plan 3; and since with this spacing it will hardly ever be necessary to use more than 150 watts per outlet, it is clear that the lighting of weave sheds is one best accomplished by a considerable number of comparatively low power lamps. It seems to the writer, therefore, that the use of large units, such as arc lamps and the big tungsten lamps consuming 250 watts or more, is not good practice. It is, of course, true that in many cases such installations will give satisfaction as compared with the installations which they surplant, but it is the writer's opinion that they can never be as satisfactory as a well designed installation using a larger number of smaller lamps."

American Items

New Books

High Efficiency Electrical Illuminants and Illumination, by Rollin W. Hutchinson, Jr. 278 pp.; illustrated; cloth. Published by John Wiley & Sons, New York. Price $2.50.

In reviewing "High Efficiency Electrical Illuminants and Illumination," by Rollin W. Hutchinson, Jr., the author states rather clearly in the preface the purpose of this book, which "does not claim to be exhaustive, nor does it purport to more than generalize on the proper use of the new illuminants for various conditions of lighting, interior and exterior.

"Much of the material for the work has been gathered from the pages of such leading periodicals as *The Electrical World* (especially), *The Illuminating Engineer, London Electrician, La Lumière Electrique* and *Electrotechnische Zeitschrift.*"

Practically all the rest of the matter in the book consists of extracts from various bulletins of lamp manufacturers. Much of this matter has been carelessly put together and many of the illustrations are very poor indeed, although undoubtedly the book would be of some value for the general reader. The central station man of progressive ideas would find much of the matter out of date, and if he has carried an index of the publications from various lamp manufacturers, including also special articles in *The Illuminating Engineer* and *The Electrical World,* he would have a much more complete and up-to-date source of reference.

On page 6 the Illuminating Engineering Society is called the National Illuminating Engineering Society.

On page 8 photometers are divided into two classes—visual acuity photometers or illuminometers, which measure the light by the ability of the eye to detect objects illuminated by it. I was not aware that Ryan's luminometer was used for measuring light, but was rather under the impression that it was used for the comparison of one source with another. I have never heard the statement made which would lead me to believe that the illumination from one source was of twice the intensity of another because a certain card could be read distinctly at a certain distance from one source which could be faintly seen with the light from another source at a similar distance.

On page 13 is given a definition of the lumen-candle, of which I am not familiar.

On page 19 is a rather peculiar statement: "The high intrinsic illumination emitted by the new filaments, coupled with their concentrated brilliancy." On page 22: "Pure tungsten is malleable to some extent, but not ductile."

On page 26, in describing the process of the General Electric Company, "the metal tungsten is rendered sufficiently ductile to be drawn into a wire," and, "it is claimed that it is possible to draw tungsten wire from rods of the metal prepared as above described by simply maintaining the metal and the dies at the proper temperature."

On pages 64 and 65 are shown a rather poor mixture of cuts. Beginning on page 77 is given a three-page quotation from an

editorial in *The Electrical World* of May, 1908.

On page 82 is given central station practice of 1908, at the time when the companies were much more afraid of tungsten lamps than they are at this date.

On page 101 there would hardly seem to be any occasion to mention the Helion lamp as brought out in 1907, inasmuch as the past four years have not rendered same commercially available.

On page 116 a carelessly drawn cut showing the distribution about flame arcs is used.

On page 135 a concrete example for determining the illumination from an Excello arc is not a well worked out example.

Page 141 the illustration showing carbons and arc of Regenerative flame arc is turned upside down.

Page 189, in opening on the principles of interior illumination, an editorial from *The Electrical World* of April, 1906, is quoted to the extent of three pages, and where in the world the statement is made " the sun at noontide, in the fullness of his power of about 1027 standard British candles . . . so that we see objects sunlit with a mean illumination of about 7000 candle-feet," this has been made to read: " 1027 standard British candles " and " 7000 candle-feet," which would bring the sun within a few inches of the surface of the earth, or lead the general reader to the conclusion that a light of one British candle at the distance the sun is from the earth would result in an effective illumination of 7 foot-candles.

On page 223, Fig. 113 is given as " intensive " instead of " focusing," and on page 224, Fig. 114, is given for " focusing " when it should be " intensive."

On page 245 is given " a table compiled by Messrs. J. R. Cravath and V. R. Lansingh, prominent illuminating engineers of Chicago."

On pages 252 to 258 are shown some very poor cuts.

The above is a review of this book, although, you will note, hardly for publication. However, I believe I have given sufficient information for you to state your conclusions as brief or as extended as you may desire.

Norman Macbeth.

Worcester Street Lighting Case; *Electrical World*, March 30.

Tungsten Post Lighting at La Crosse, Wis.; *Electrical World*, March 30.

Gas Lamps vs. Indirect Lighting, by Albert Scheible; *Electrical World*, March 30.

The writer sets forth three objections which he claims make indirect gas lighting a practical impossibility. The principal objection urged is the impossibility of obtaining a highly efficient reflector which will withstand the heat. The writer evidently refers to the ordinary silvered glass reflector painted on the outside. His concluding argument is as follows:

"The fact that lighting methods which are strongly recommended by some, even though not favored by others, are at present out of the question with gas, cannot be too strongly impressed on contract agents and others who come into direct contact with gas competition."

The article is commented on editorially in this issue.

Lighting of the City Hall and County Buildings, Chicago; *Electrical World*, March 30.

Tungsten Lamps in Dirty Places; *Electrical World*, April 6.

Sign Lighting in Louisville, Ky.; *Electrical World*, April 6.

Ornamental Street Lighting in Fort Wayne, Ind.; *Electrical World*, April 6.

Freight Yard Lighting, by W. S. Austin; *Electrical World*, April 6.

A very interesting article on the handling of the problem of lighting a railway freight yard by means of the regenerative flame lamp at Dupo, Ill. The writer says in conclusion:

"The intensity of illumination secured equaled all expectations, and when the lamps were started up in the north half of the yard the effect produced was such that engineers on trains crossing the Eads and Merchants'

bridges, 12 miles away, could plainly see the illumination, and residents as far distant as 10 miles telephoned to ask what was burning at Dupo. Since the system has been put in operation it has been possible to secure results in operating and policing the yard at night such as have never been approached elsewhere."

THE COMPARISON OF ILLUMINANTS, by R. Hillberg; *Electrical World*, April 6.

NEW TYPE ARC LAMPS FOR CHICAGO'S STREET LIGHTING; *Electrical World*, April 13.

The following gives the details:

"Although the exact specifications for the additional new lamps which are to be installed have not been drawn up, it seems now practically certain that the lamps specified will be of a new type. The lamp under consideration is of the series alternating-current 60-cycle flame arc type, taking not over 60 volts at the lamp terminals at 10 ampere. The arc will be inclosed and the minimum hours of burning with one trim will probably be specified as 100. Eight thousand lamps will be taken on the first order, which will later be increased by 2000 lamps."

TUNGSTEN POST LIGHTING WITH PRISMATIC REFLECTORS IN CINCINNATI; *Electrical World*, April 13.

ILLUMINATION OF THE CATHEDRAL OF ST. JOHN THE DIVINE, NEW YORK; *Electrical World*, April 13.

An illustrated article describing the lighting installation, especially its electrical features, such as methods of control, etc., in full.

TRIMMING AND INSPECTION OF ARC LAMPS IN PHILADELPHIA; *Electrical World*, April 20.

COMPARISON OF THE OPERATING CHARACTERISTICS OF VARIOUS ILLUMINANTS, by Isidor Ladoff; *Electrical World*, April 20.

A very comprehensive treatment of the subject by this well known authority. Tables are given giving the relative efficiencies of modern illuminants, comparative costs of light from various sources, visible and invisible rays, and spectroscopic comparisons of different lights, mechanical equivalent of light of different wave lengths, visibility of light at low intensities, visibility at various intensities at meter candles, and temperature comparisons. Various curves are also given showing other data. A valuable reference article.

GAS LAMPS VS. INDIRECT LIGHTING, by Norman Macbeth; *Electrical World*, April 20.

A letter written by Mr. Macbeth in answer to Mr. Scheible's article above referred to. The writer corrects Mr. Scheible's statements as to the cost of pilot lights, and suggests that the electric lighting interests put in indirect lighting on account of its inefficiency, which causes it to require a greater amount of current, and states that there is more regular gas lighting business undeveloped than the lamp manufacturers can take care of, or they neither have the time nor inclination to devote to indirect lighting systems, and that indirect lighting with tungsten lamps having a specific brilliancy of 1000 candlepower per square inch may be a greater necessity than with mantle burners having one-tenth that intensity.

ELECTRIC STREET LIGHTING, by Albert Scheible—Chapters I., II., III., IV.; *Electrical Review and Western Electrician*, April 1, 8, 15 and 22.

A series of articles treating quite fully the history of street lighting with special attention to development of electric street lighting.

A valuable reference article on the subject.

ILLUMINATION OF DENVER'S MOVING PICTURE THEATRES, by Joseph A. McMeel; *Electrical Review and Western Electrician*, April 8.

A short illustrated article on the use of light in connection with the moving picture shows in Denver.

ILLUMINATION IN NEW HAMBURG; *Canadian Electrical News*, April.

A short illustrated article on the lighting in the town of New Hamburg, Ont.

ELECTRIC SIGNS IN TORONTO, by Eugene Creed; *Canadian Electrical News*, April.

A short article showing a number of the very elaborate electric signs used in Toronto.

Electric Light Gives Bright Welcome in Muskogee; *Electric City*, April.

A short illustrated article on the new welcome arch installed in Muskogee, Okla.

A Gas White Way, by K. L. Simons; *Progressive Age*, April 1.

A short illustrated article on the new "Gas White Way" at Ensley, Ala.

Displaying Gas Arcs to Advantage, by H. K. Dodson; *Progressive Age*, April 1.

A short illustrated article describing the use of a vacant building in Baltimore by the lighting company for displaying the use of gas arc lamps.

Gas Arc Maintenance, by A. Goldsworthy; *Progressive Age*, April 15.

Inverted Gas Arc Lighting in Baltimore, by H. K. Dodson; *American Gas Light Journal*, April 3.

Reflectors and Incandescent Mantles, by Norman Macbeth; *National Commercial Gas Association Bulletin*, April.

The Dazzling Use of Light, by Louis C. Tiffany; *Scientific American*, April 15.

The writer treats most interestingly of the subject of color in decoration and in illumination. This is one of a few articles treating of the artistic side of illumination written of the acknowledged master of the subject and contains much valuable matter for an illuminating engineer.

Light and Shadows, by E. C. Crittenden; *Scientific American*, April 15.

This is an illustrated article by the Assistant Physicist of the Bureau of Standards, Washington. After describing the effect by a bare light-source in the field of vision, the writer says: "The remedy is obvious; we must have shields over our eyes or over the lamps." He then takes up indirect illumination as a solution of the glare problem, showing its use in residences and offices. The theory that too uniform a light may be undesirable is dealt upon, and the system of transmitted light through glass ceilings is explained; the Auditorium of the United Engineering Societies Building being given as an example.

Lamps of To-day, by Joseph B. Baker; *Scientific American*, April 15.

A popular article describing briefly the various kinds of modern light-sources with illustrations showing the Moore White Light window, the Cooper Hewitt lamp and a mantle lamp using denatured alcohol.

Light and Power on the Farm, by Putnam A. Bates; *Scientific American*, April 15.

An illustrated article showing the various conveniences of electricity in the home; a popular treatment of the small electric plant suitable for installation on the farm.

Inventing the Light of the Future; *Scientific American*, April 15.

(See special editorial comment on the subject.)

Increasing Production by Improving Lighting; *American Industries*, April.

Lighting the Office Building, by Roscoe Scott; *Building Management*, April.

This is Chapter 1 of a series, and deals with the lighting of vestibules and corridors.

A New Form of Direct Reading Candle-Power Scale and Recording Device for Precision Photometers, by George W. Middlekauff; *Bulletin of the Bureau of Standards*, February.

A full description of a new automatic recording device for photometers as developed at the Bureau of Standards, Washington, D. C. The conclusion states that the apparatus has been in use almost daily during the past year and has proved itself entirely satisfactory. It has eliminated the computations which formerly occupied the entire time of at least one computer and sometimes of that of two.

The eye is not unnecessarily fatigued by alternate reading of the photometer, screens and scale, and the observer is almost entirely freed from prejudice in making settings.

The record is simple, permanent and complete and is usually read, checked and filed for future reference.

PLACING THE OUTLET, by E. B. Rowe; *Selling Electricity,* April.

CURB LIGHTING ON A RESIDENCE STREET, by Ludwig Kemper; *Selling Electricity,* April.

HOTEL LIGHTING BY INCANDESCENT LAMPS, by Roscoe Scott; *Hotel Bulletin,* April.

This is the first of a series of articles to appear on this subject.

Editorials

Electrical World:

PORTABLE SEARCH LANTERNS; April 13.

CHARACTERISTICS OF ILLUMINANTS; April 20.

Electrical Review and Western Electrician:

METAL LAMPS; April 1.

ELECTRIC STREET LIGHTING; April 1.

Engineering Record:

ILLUMINATION AND ACCIDENTS; April 8.

A discussion of Mr. Calder's paper, which is reviewed elsewhere in this issue. The conclusion is as follows:

"The difference in cost between good lighting and poor lighting in workshops is generally comparatively small. Indeed, it has not infrequently been found that the lighting can be improved and the bills lowered at the same time, while there is no doubt whatever of the salutary effect of ample illumination on the quantity and quality of the product. For this reason, if for no other, more attention should be paid to suitable lighting than is now usual. And even from an entirely selfish standpoint, it is much better to pay for good light than to settle for accidents resulting from its absence."

Scientific American:

WILL THE TUNGSTEN LAMP RAISE RATES? April 15.

THE BUNSEN CENTENARY; April 15.

Southwestern Electrician:

LAMP EVOLUTION; March.

Foreign Items

COMPILED BY J. S. DOW.

Illumination and Photometry

SCHOOL LIGHTING (discussion at meeting of the Illuminating Engineering Society in London, March 16; *Illum. Eng.,* Lond., April; see also *J. G. L.,* March 21; *G. W.,* March 18; *Electrician,* March 19, etc.).

Contains the full discussion on this subject, including particulars of the results of visits and tests at a number of schools in London. Some photographs are shown illustrating methods of gas and inverted electric arc lighting, and tables are presented summarizing the amount of illumination provided for the desks, blackboards, etc., in a number of cases, including several well-known English public schools, such as Harrow, Dukwich, St. Paul's, etc. *The Illuminating Engineer* (London) for April contains an *editorial* summarizing the chief conclusions drawn from the discussion. Most of these have reference to the need of avoiding glare, the intensity of illumination required, etc. It is recommended that the desk illumination should be at least 3 foot-candles for ordinary work, and that for processes which are specially taxing to the eyes, sewing, shorthand, etc., more than this is needed. A specially interesting feature was the range of illumination provided in the Arts and Crafts School of the L. C. C., where a variety of special work, including jewelry, metal decoration, compositor's work, etc., is carried on.

ILLUMINATION AND THE PREVENTION OF ACCIDENTS (editorial, *Illum. Eng.,* Lond., April).

Comments upon the recently issued re-

port of the Commission on Accidents in Factories in Great Britain. The report lays special stress on the importance of properly illuminating dangerous machinery, and suggests that, without making too precise recommendations as regards the actual standard of illumination at the present stage, inspectors should nevertheless pay special attention to lighting conditions with a view of securing the necessary data.

SURFACE BRIGHTNESS: ITS MEASUREMENT AND ITS APPLICATION TO PHOTOGRAPHY, by J. S. Dow and V. H. Mackinney (paper read before the Royal Photographical Society, March 28; not printed yet).

The paper points out the enormous variation in brightness of objects illuminated by daylight and artificial light (or self-luminous), with which photographers have to deal. Yet the actual final print cannot present a variation in brightness of more than about 30:1. Charts of the fluctuations in daylight during three successive days are given, demonstrating that theoretical tables of exposure, etc., according to the time of the year, may be falsified in actual practice. Actinometers can also give only approximate guidance, and the authors suggest the desirability of measuring the actual brightness of distant objects. As an illustration, a number of photographs taken by daylight and by the light of artificial illuminants of various kinds are given, the exposure in each case being estimated by observing the surface brightness of the chief objects in the field of view. The question of color and its effect on results is also referred to.

LIBRARY LIGHTING, by L. B. Marks (*Illum. Eng.*, Lond., April).

Contains some particulars of the illumination of the Library of Congress at Washington, with special reference to stack lighting. The use of time-switches in diminishing the loss of energy owing to lights being carelessly left on is also described.

STREET LIGHTING CONTRACTS (*G. W.*, March 18; editorial).

A few remarks on the possibility of framing a street lighting specification based on illumination. Some difficulties in this suggestion are pointed out.

Electric Lighting

ELEKTRISCHE BELEUCHTUNG VON KAISCHUPPEN, by A. Boje (*E. T. Z.*, March 23).

An interesting article giving full particulars of tests as to the cost of lighting wharfs and piers for shipping by various electrical illuminants. Plans showing the distribution of illumination are also given and an interesting novelty is a solid model of the yard to scale the actual curves of illumination on the ground, being mapped out in solid material.

STREET LIGHTING BY MODERN ELECTRIC LAMPS, by Haydn T. Harrison (*Jour. of the Inst. of Elec. Engrs.*, Lond., February, 1911).

This paper has been referred to before. It is now published officially, with the full discussion, in the *Institution of Electrical Engineers' Journal* (London).

DIE STRAHLUNGSEIGENSCHAFTEN DER ELEKTRISCHEN GLUHLAMPEN, by G. Leimbach (*E. T. Z.*, March 16).

Describes tests on a number of electric lamps, including experiments on the radiant efficiency. The author points out that many of the past methods employed in such work are subject to errors, and considers that in all probability the luminous efficiency, even of the most efficient electric incandescent lamp, does not exceed 5 per cent.

Gas, Oil, Acetylene Lighting, Etc.

DIE PYROPHOREN METALLE UND IHRE BEDEUTUNG FUR DIE MODERNEN FEUERZEUGE, by C. R. Bohm (*Z. f. B.*, Feb. 28).

Describes methods of producing a flame by rubbing pyrophoric materials, cerite, etc., and summarizes the chief patents which have appeared on the subject.

HIGH PRESSURE SHOPLIGHTING, by A. E. Broadberry (discussion *J. G. L.*, March 14).

This is an account of the discussion of the paper formally noticed. Reference is made, among other matters, to the risk of

breakage of globes from the flame shooting out when the lamps are lighted up, and data are given regarding the upkeep of high pressure lamps by shop keepers.

Distribution Curves for Street Lamps, by J. G. Clark (*J. G. L.*, March 14).

A letter advocating that more detailed particulars should be furnished regarding the effects of reflectors with street lamps, and especially polar curves of light distribution for each unit, so that the best lamp for any particular purpose can be more readily selected.

Die Zukunft des Leuchtgases, by W. Eisele (*J. f. G.*, March 11).

Replies to some criticisms on a former paper, in which the prospects of gas lighting had been discussed. It had been objected that his anticipations in this respect were not as favorable as circumstances justified. The author concludes by expressing his conviction that gas and electricity have each their respective fields, and it would not be right to assert that either was invariably the better to use. These views are interesting as indicating the spread of ideas held by illuminating engineers on these subjects.

Some Gaslighted Schools, by F. W. Goodenough (*Illum. Eng.*, Lond., April).

A description, accompanied by photographs taken by artificial light, of the gas lighting in some London schools. Precise data regarding each installation are also tabulated. The desk illumination in the case of different schools ranges from about 2½ to 5 foot-candles.

The Theory and Practice of Petrol Air Gas, by C. Scott Snell (*G. W.*, March 11).

Account of a lecture in which petrol air systems and gas are compared and an attempt is made to compare their relative economy.

Presidential Address Before the Manchester District Institution of Gas Engineers, by R. Watson (*J. G. L.*, Feb. 28; *G. W.*, March 4).

Contains special reference to progress in illuminating engineering in a review of the past year, and some remarks on the possibility of framing a standard specification for street lighting.

Gaslighting for Railway Carriages (*J. G. L.*, Feb. 28; March 7).

An interesting summary of progress in railway carriage lighting by compressed gas, Pintsch gas, etc. The chief difficulty when coal gas was used with flame burners was that its illuminating power fell rapidly with storage under pressure. Hence, the more stable Pintsch gas was introduced. But when incandescent mantles came to be used this drawback was avoided, as the *calorific value* decreases much less quickly. Some data are given on the question of renewing mantles. On main lines they are usually renewed every two months; on suburban lines, owing to the less uniform and unequal motion, every five weeks. A pressure of 8 to 20 inches of water is usually employed.

L'Eclairage des Fetes Foraines (*Rev. des Eclairages*, March 15).

Refers to the recently issued police regulations in France on the subject of methods of lighting at fairs, etc. These regulations are specially favorable to dissolved acetylene.

Le Prix de Revinet des Eclairages pour la Projection et le Cinematographie (*Rev. des Eclairages*, March 15).

A comparison of the cost of various methods as illuminants used for projectors for cinematographic work, etc.

Neue Hangegaslampe (*J. f. G.*, Feb. 25).

Moderne Gasbeleuchtungsgegenstande (*J. f. G.*, March 4).

Neuere Verfahren zur Herstellung von Gasluhkorpern (*Z. f. B.*, Feb. 28).

Contractions used:

Elek. Anz. *Elektrischer Anzeiger.*
E. T. Z. *Elektrotechnische Zeitschrift.*
G. W. *Gas World.*
Illum. Eng. Lond. *Illuminatig Engineer (London).*
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
J. G. L. *Journal of Gaslighting.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The
Illuminating Engineer

Vol. VI JUNE, 1911 No. 4

THE SUPREME BEING

The supreme being on this earth is Man. Through countless changes and perfections, extending through eons of time, he has risen to the position of supreme visible ruler of all things mundane. All philosophies and theologies agree upon this fact.

But let it be well understood that it is Man, not men, that is supreme. It is the individual, not the genus homo, that is working out the human destiny.

It is this supremacy of the individual that differentiates modern from ancient civilization. Since science harnessed the inanimate forces of nature Man has ceased to be a mere engine of force, and has more and more come to use his divine power of thought. That the individual shall have the greatest possible opportunities for exercising his divinely human prerogative, and sacrifice as little to the greed or need of men, is the basis of modern society, and the principle upon which future progress will be made. The efficiency of humanity as represented in the state, social or political, is the consummation of the efficiency of the individual. Every facility and opportunity which will conduce to this individual efficiency is therefore of prime importance from every point of consideration. Man develops first through perception; he can advance no farther nor faster than he can see. The eyes are the commissary department for the brain, without which there could be no independent existence. To protect and sustain the organs of vision is therefore the first and most important of all acts in promoting individual efficiency.

Science has bestowed no greater blessings upon man than the means of producing artificial light at a cost so low as to bring it within the use of the poorest, and the discovery of cheap and effective means of correcting the deficiencies of nature in the optical construction of the eye.

Man has become supreme because of the power of thought, and the power of thought is a direct result of the power of sight. Extinguish this wonderful faculty of vision, and all animal life on this planet would soon be reduced to the primitive condition of the invertebrate.

Let us, therefore, protect and preserve this faculty by which we have ascended from mere microscopic organisms to a seeing and thinking individual moulded in the image of God.

E. L. Elliott.

In Lighest New York

By E. Leavenworth Elliott.

With an Historical Sketch by Robert Louis Stevenson

ILLUSTRATIONS BY VERNON HOWE BAILEY.

Cities given, the problem was to light them. How to conduct individual citizens about the burgess-warren, when once heaven had withdrawn its leading luminary? or —since we live in a scientific age—when once our spinning planet has turned its back upon the sun? The moon, from time to time, was doubtless very helpful; the stars had a cheery look among the chimney-pots; and a cresset here and there, on church or citadel, produced a fine pictorial effect, and, in places where the ground lay unevenly, held out the right hand of conduct to the benighted. But sun, moon, and stars abstracted or concealed, the night-faring inhabitant had to fall back—we speak on the authority of old prints—upon stable lanthorns, two stories in height. Many holes, drilled in the conical turret-roof of this vagabond Pharos, let up spouts of dazzlement into the bearer's eyes; and as he paced forth in the ghostly darkness, carrying his own sun by a ring about his finger, day and night swung to and fro and up and down about his footsteps. Blackness haunted his path; he was beleaguered by goblins as he went; and, curfew being struck, he found no light but that he traveled in throughout the township.

Closely following on this epoch of migratory lanthorns in a world of extinction, came the era of oil-lights, hard to kindle, easy to extinguish, pale and wavering in the hour of their endurance. Rudely puffed the winds of heaven; roguishly clomb up the all-destructive urchin; and, lo! in a moment night re-established her void empire, and the cit groped along the wall, suppered but bedless, occult from guidance, and sorrily wading in the kennels. As if gamesome winds and gamesome youths were not sufficient, it was the habit to sling these feeble luminaries from house to house above the fairway. There, on invisible cordage let them swing! And suppose some crane-necked general to go speeding by on a tall charger, spurring the destiny of nations, red-hot in expedition, there would indubitably be some effusion of military blood, and oaths, and a certain crash of glass; and while the chieftain rode forward with a purple coxcomb, the street would be left to original darkness, unpiloted, unvoyageable, a province of the desert night.

The conservative, looking before and after, draws from each contemplation the matter for content. Out of the age of gas lamps he glances back slightingly at the mirk and glimmer in which his ancestors wandered; his heart waxes jocund at the contrast; nor do his lips refrain from a stave, in the highest style of poetry, lauding progress and the golden mean. When gas first spread along a city, mapping it forth about evenfall for the eye of observant birds, a new age had begun for sociality and corporate pleasure-seeking, and begun with proper circumstance, becoming its own birthright. The work of Prometheus had advanced by another stride. Mankind and its supper parties were no longer at the mercy of a few miles of seafog; sundown no longer emptied the promenade; and the day was lengthened out to every man's fancy. The city-folk had stars of their own; biddable, domesticated stars.

It is true that these were not so steady, not yet so clear, as their originals; nor indeed was their luster so elegant as that of the best wax candles. But then the gas stars, being nearer at hand, were more practically efficacious than Jupiter himself. It is true, again, that they did not unfold their rays with the appropriate spontaneity of the planets, coming out along the firmament one after another, as the need arises. But

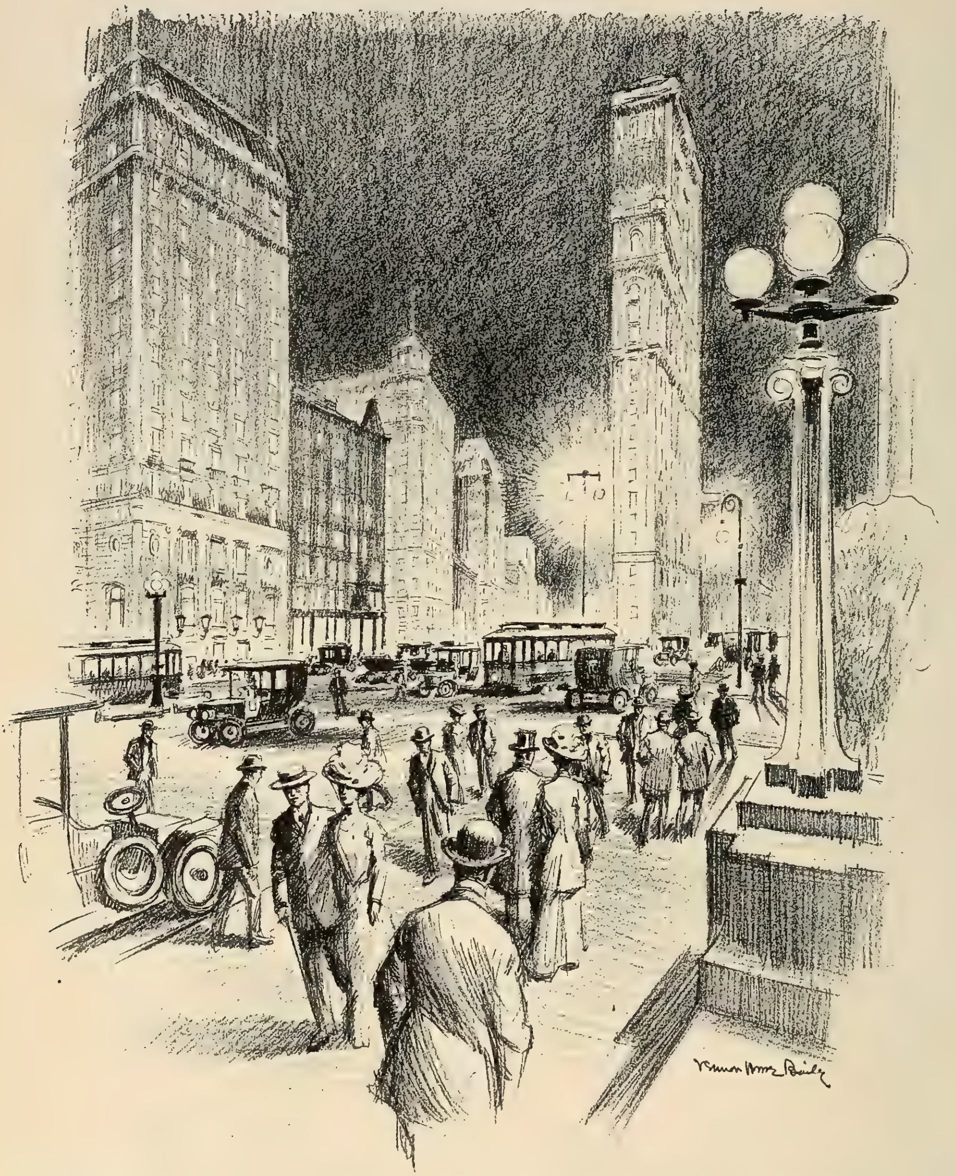
the lamplighters took to their heels every evening, and ran with a good heart. It was pretty to see man thus emulating the punctuality of heaven's orbs; and though perfection was not absolutely reached, and now and then an individual may have been knocked on the head by the ladder of the flying functionary, yet people commended his zeal in a proverb, and taught their children to say, "God bless the lamplighter!" And since his passage was a piece of the day's programme, the children were well pleased to repeat the benediction, not, of course, in so many words, which would have been improper, but in some chaste circumlocution, suitable for infant lips.

God bless him, indeed! For the term of his twilight diligence is near at hand; and for not much longer shall we watch him speeding up the street and, at measured intervals, knocking another luminous hole into the dusk. The Greeks would have made a noble myth of such an one; how he distributed starlight, and, as soon as the need was over, re-collected it; and the little bull's eye, which was his instrument, and held enough fire to kindle a whole parish, would have been fitly commemorated in the legend. Now, like all heroic tasks, his labors draw toward apotheosis, and in the light of victory himself shall disappear. For another advance has been effected. Our tame stars are to come out in future, not one by one, but all in a body and at once. A sedate electrician somewhere in a back office touches a spring—and behold! from one end to another of the city, from east to west, there is light! *Fiat Lux,* says the sedate electrician. What a spectacle, on some clear, dark nightfall, when in a moment, in the twinkling of an eye, the design of the monstrous city flashes into vision—a glittering hieroglyph many square miles in extent and when, to borrow and debase an image, all the evening street-lamps burst together into song! Such is the spectacle of the future. Star-rise by electricity, the most romantic flight of civilization. ROBERT LOUIS STEVENSON.

"Star-rise by electricity!" What would our beloved Robert Louis say if he could behold the spectacle presented by New York of an evening in this year of grace 1911? With what quaintly rich metaphor would he describe the constellations and luminous portents that cause the "Great White Way" to hide the Milky Way, as the arc lamp of to-day would extinguish the perambulating lanthorn of a century ago? And what more impressive exhibition of the headlong strides of Prometheus than the city-full of pleasure-seekers radiating themselves from Times Square at electric star-rise, and deserting the brilliant thoroughfares only in season to make room for those untimely routed from their beds to cater to our morning wants? The promenade is indeed not emptied by sundown, nor by any other progress of the planets, and supper parties regard not the sea fog!

There is probably no feature of urban conditions of a century ago that is more difficult to conceive than the darkness and desertion that took possession of cities with the extinction of natural light; nor do we give any adequate thought to what it means to have "the day lengthened out to suit every man's fancy." Light alone has doubled the span of life, so far as its real measurement is concerned. Instead of commanding that the city be razed and rebuilt three leagues inland as the most effective means of destroying a rival power, as the Romans did with Carthage, it would be sufficient for the jealous conqueror of New York to-day to insist that no lamps be lighted in the streets between sunset and sunrise. Men would flee from the gloom as from a plague, and take with them the life-blood which we call commerce, and the nerves and brain of social enjoyment, and leave only a mummified city.

New York is the metropolis of the western hemisphere. Every inhabitant exults in this fact, secretly or openly; others envy, belittle, rejoice or glorify, according to their natures: all admit the fact. This supremacy in numbers and wealth and general magnificence makes it the natural leader in those things which are the result of men and money. In how many cities and towns can you not find a Broadway? And since *the* Broadway became *the* "White Way," there is fast springing up a similar collection of "White Ways" throughout the land. To be "the best lighted city"—that in-



THE LUMINOUS CENTER OF THE "GREAT WHITE WAY," TIMES SQUARE, LOOKING DOWN FROM THE HOTEL ASTOR.

deed is a goal well worth the striving for. Emulation in well doing is a virtue not to be despised; nor can the goal be too high. "Hitch your chariot to a star," and even though it be but one of the "biddable, dependable stars"—you shall fare better than being eternally satisfied groping along by the few struggling radiations from the old tin lantern.

Things are large or small, not absolutely but relatively. New York is large in geographical extent, in population and wealth; it follows that many things which would, in a smaller city, be exceedingly conspicuous fall into ordinary perspective in New York. Among these public lighting is included. New York contains a great number of street lights and more

A DRIVE IN CENTRAL PARK.

miles of well lighted streets than any other city on the western continent. This is a simple necessity arising from physical conditions. Rather than being a fact to boast of it is only a normal condition, the negative of which would be occasion for shame and regret. New York *ought* to be the best lighted city in this country. The sum of money annually expended for public lighting is enormous—more than the entire budget of the majority of towns, and enough to run a foreign kingdom, but as an item in the total sum it fails to attract unusual attention. That the stupendous work is carried out by a single corporation, and so smoothly and unobtrusively, under the guidance of the municipal authorities, as to be accepted as a matter of course without blame or praise, is perhaps the best comment that could be passed upon it.

The two best known thoroughfares in America are Fifth Avenue and Broadway. Their intersection at Twenty-third Street marks the beginning of the "White Way," which extends northward along Broadway to Long Acre Square, where Seventh Avenue, crossing obliquely, cuts out two triangles, which by some peculiar license are known as "squares"—the southerly, Times Square, and the northerly, Long Acre Square.

With the steady progress of business and amusement—for work and play go together—from the Battery toward the Harlem River these two Squares have now become the center of nocturnal activity. Within a few blocks radius of this center are hotels, cafés, and theatres enough to entertain the entire population of a first-class provincial city. And here, as we would expect, are lights innumerable. Looking down from Long Acre Square the eye first encounters the magnificent Astor lamp standards in the immediate foreground. These are elaborate pieces of carved bronze, and are the gift to the city from Wm. Waldorf Astor. Beyond, and towering above these, is a tall post supporting two electric lamps, whose flood of soft, white light illuminates the whole Square, but so unostentatiously that the wayfarer would scarcely suspect their tremendous power, for each gives more light than 2000 candles. The lamp itself is the invention of Prof. André Blondel, a citizen of America's early national friend, France. Beyond this are the arc lamps that are indigenous to American soil, and which have served so long and well in the great work of public lighting. Besides these luminaries maintained at public expense the perspective is thickly sown with incandescent lamps, marking out patterns and legends of wonderful brilliancy and beauty, many of which are of prodigious proportions. By the light of this varied collection of lamps visible from the inter-

A GLIMPSE OF RIVERSIDE DRIVE.

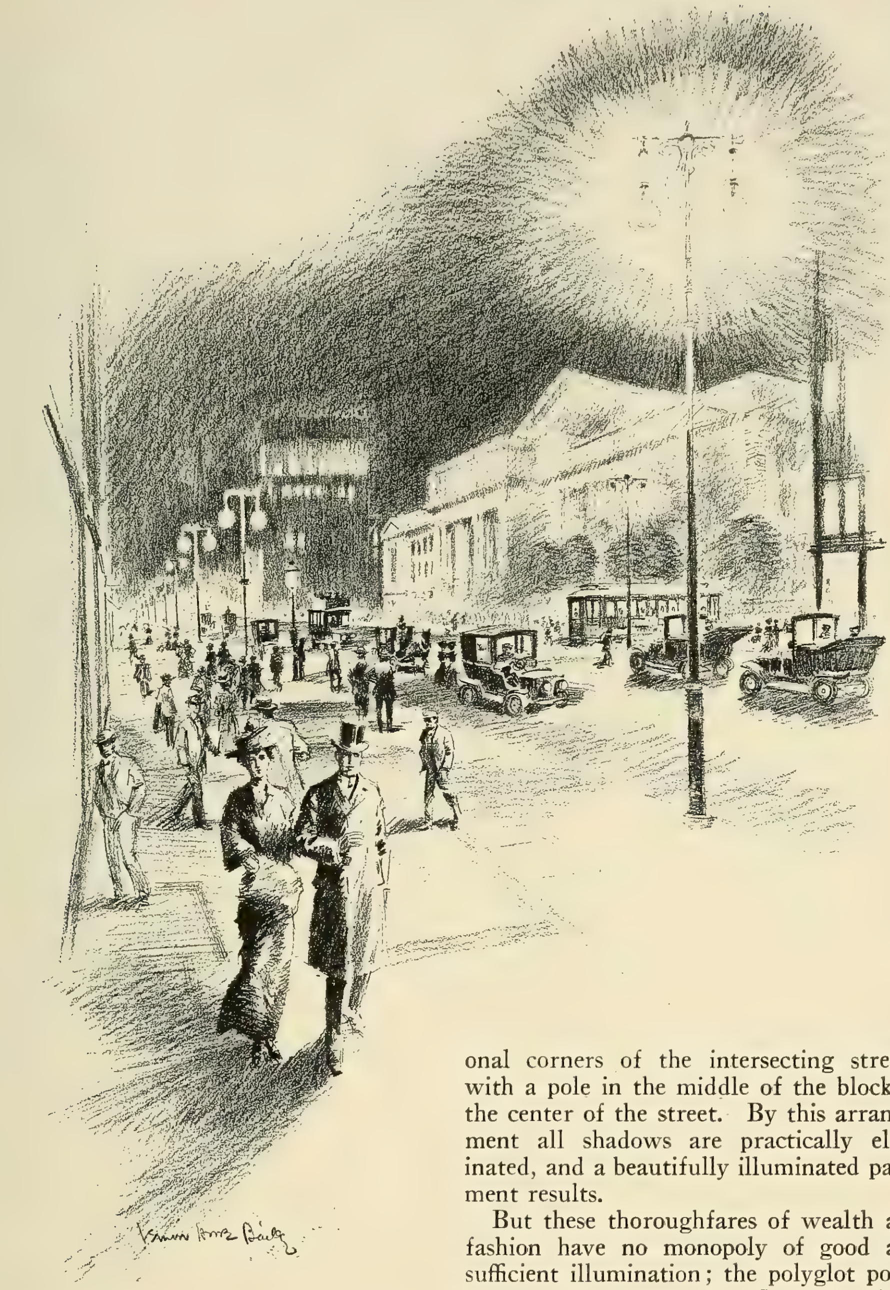
section of Broadway with Forty-second Street more people nightly go their ways than in any other spot on the American continent, if not in the whole world; it is here that the "Great White Way" ends in a blaze of glory.

Fifth Avenue is the city's pride. The irresistible tide of business, starting at its beginning in Washington Square, has now swept practically all before it beyond Forty-second Street well nigh to Fifty-ninth Street, where the avenue is flanked on the left by Central Park. Of the scores of majestic buildings within this stretch of thoroughfare the new Public Library is by all odds the most gorgeously magnificent. Fortunately, it possesses a site that is worthy of the structure, occupying the eastern portion of Bryant Park. Of all the "best lighted streets" in the country this section of Fifth Avenue takes precedence. On each block, which is 250 ft. in length, there are two lamp-posts on one side of the street at the corners, and one on the opposite side in the middle, each post supporting two of the largest commercial size of inclosed arc lamps. As the arrangement provides lamps on diagonally opposite corners, each block has the advantage, to a large extent, of the illumination from five posts, or ten lamps. The posts are omitted in front of the library, giving an unobstructed view of the superb façade.

"If thou wouldst view fair
Melrose aright
Go visit it by pale moonlight,"

advised Sir Walter Scott. If you would take your first view of the new library, with its white marble façades standing out like a cameo against the dark setting of the sky, under the light of the electric stars you would perhaps be following equally good advice. And when this scene has been enjoyed do not fail to pass on to the corner of Thirty-ninth Street, where nearly the entire stretch of luminous Fifth Avenue, extending from Washington Arch on the south to Eightieth Street on the north can be observed, the double row of lamps marking out the way like a string of radiant jewels.

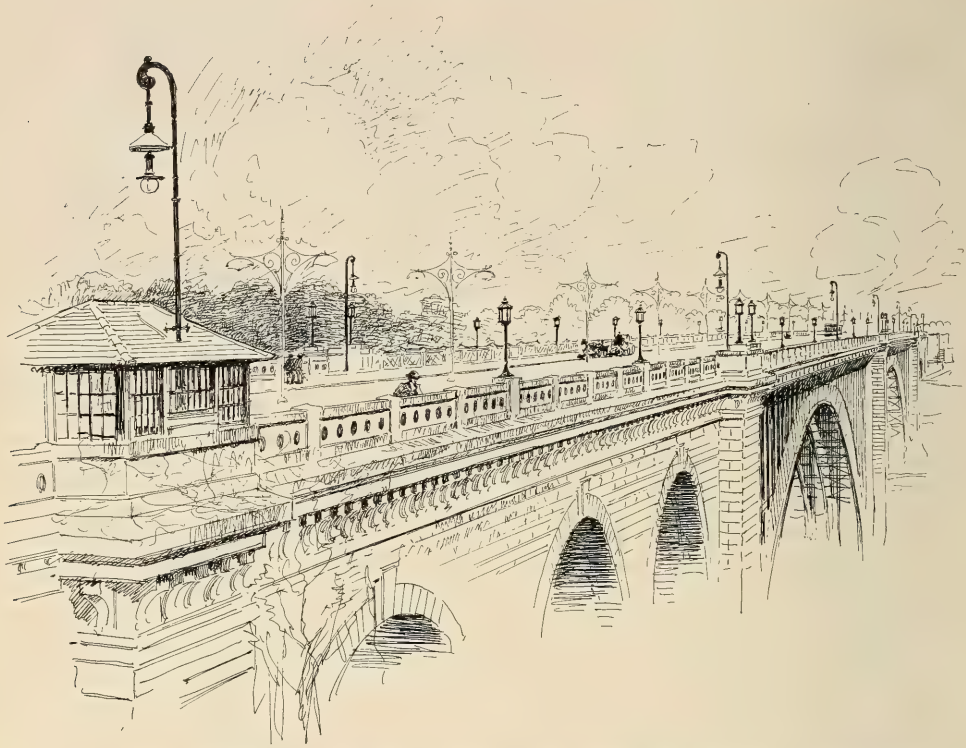
Beyond Central Park Manhattan Island widens, and here the streets widen also, as if expanding by sheer freedom from restraint. Seventh Avenue, starting at 110th Street, the northern boundary of the park, extends to the Harlem River at 157th Street in the glorified condition of a parkway, or boulevard, with a total width of 200 ft., with a liberal strip of greensward in the middle. This presented a somewhat difficult problem in illumination, the trees on either side and the unusual width of the street presenting unusual conditions; but how well the



LOOKING DOWN "THE AVENUE" FROM FORTY-THIRD STREET. THE NEW PUBLIC LIBRARY ON THE RIGHT.

problem has been solved a single view will show. There are arc lamps suspended from handsome mast-arms at diagonal corners of the intersecting streets, with a pole in the middle of the block in the center of the street. By this arrangement all shadows are practically eliminated, and a beautifully illuminated pavement results.

But these thoroughfares of wealth and fashion have no monopoly of good and sufficient illumination; the polyglot population of the lower East Side is at least supplied with physical light. Among the old slum quarters of the city perhaps none has retained its identity more completely than that centering about Mott and Pell streets, long the particular stamping ground of the Chinese contingent. In these narrow streets, where the sidewalks



THE WASHINGTON BRIDGE SPANNING THE HARLEM RIVER, NEAR THE HISTORIC "KINGSBRIDGE."

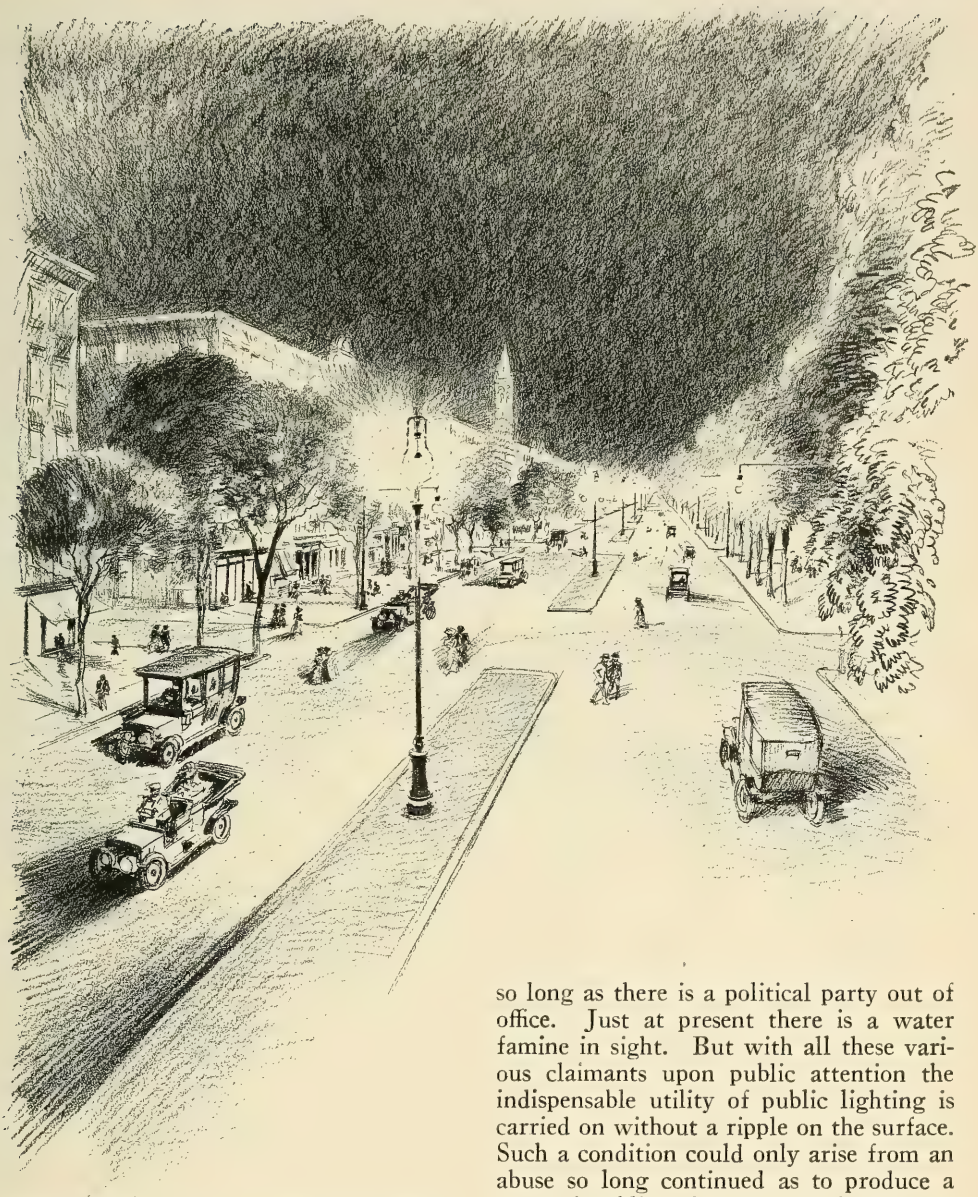
are scarcely more than footpaths, walking space is valuable, and even the bases of the lamp-posts have been contracted to the last limit of mechanical practicability, some eight inches of space being saved in this manner. The posts themselves are placed against the building instead of on the curb line to further facilitate the congested traffic of this quarter.

Public parks are in a sense the lungs of a great city. It is in these that a supply of fresh air and oxygen is to be obtained for keeping the human machine running; and the most valuable use of these breathing spots is by night, when those who most need the refreshment of pure air are at liberty to seek them; hence the vital necessity of light. The electric lamp has now largely superseded the gas light, and the still more primitive gasoline lamp. Mazda and tungsten lamps have been a godsend to those who depend upon the parks for an evening's rest and pleasure. It is easy to place, reasonable to maintain, and because of its moderate size can be scattered liberally among trees and shrubbery, thus eliminating impenetrable shadows which are sure to prove danger spots.

Riverside Drive, with its unsurpassed view of the Hudson, is one of the finest promenades in the world, and its modern lighting has made it as available for all classes by night as by day. The famed Central Park has been likewise greatly enhanced in value by the splendid system of illumination provided.

No architectural structure is complete in this age of light without ample provision for its illumination, and this provision is properly made a means of structural embellishment, as well as practical utility. The Washington Bridge is an illustration of this use of light, the structure being provided with lamps on abutments primarily for decorative purposes, with posts at the ends for the general illumination.

There is never a day in New York without some agitation for change or reform. A "shake-up" in the Police De-



UPPER SEVENTH AVENUE, A TWO-MILE STRETCH OF BRILLIANTLY LIGHTED BOULEVARD.

partment has become so common that the disturbance produced on the general public would scarcely be traceable by a seismograph; an occasional disastrous fire may produce a nine days' spasm of reform in building laws, and political crimination and recrimination will never cease so long as there is a political party out of office. Just at present there is a water famine in sight. But with all these various claimants upon public attention the indispensable utility of public lighting is carried on without a ripple on the surface. Such a condition could only arise from an abuse so long continued as to produce a state of public palsy, or a service so generally satisfactory as to afford no opportunity for the greedy headline writer or the chronic agitator. A single glance at any part of the greater city is sufficient to rule out the first of these possibilities. The simple fact that the lighting of the city has proceeded for many years, during which great changes and advancements have taken place in the art without attracting public attention, is the best evidence that

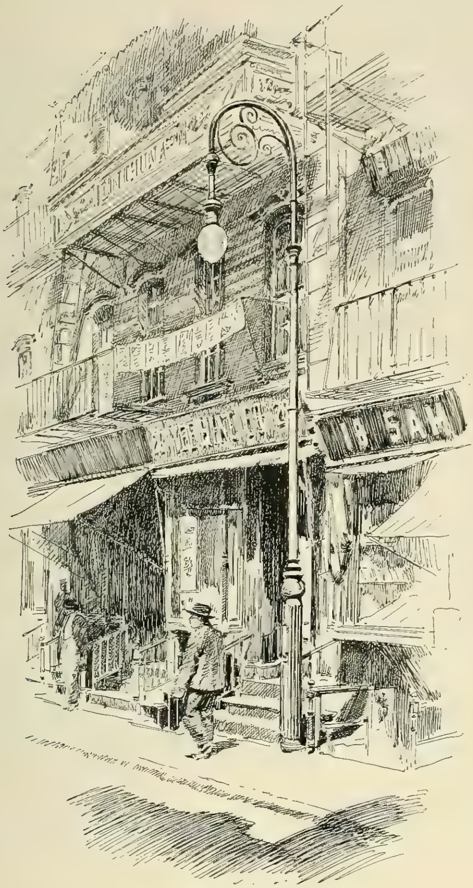
the officials entrusted with this task have performed their duty with a high degree of skill and discretion.

There is undoubtedly no other city in this country in which so much practical and careful experimenting has been done to determine the best methods of public lighting. What appears to the ordinary onlooker as a mere matter of course is, in reality, the result of continuous and careful thought, and the application of true "scientific management" to a great public utility. The height of lamp-posts, their distance apart, their arrangement in the particular street or section, the kind and light-power of the lamps, are all matters of careful engineering. Furthermore, the artistic side of the problem is given equally careful attention, every type of lamp-post in the city being passed upon by a municipal art commission. Every new light-source suitable for exterior use is given a practical trial as soon as it has reached the commercial stage, and there is no type of unit that is not in actual use to some extent somewhere in the city.

It would be a simple matter to produce a spectacular glare of light in some particular quarter or section of the city that would attract general attention and comment, and probably lead the beholder to exclaim, "Behold, the best lighted city!" while miles of gloomy and half-lighted thoroughfares would escape attention. But this has fortunately never been the policy of those having the matter in charge. While New York has miles of streets that in brilliancy and beauty of illumination are models of modern street lighting, it is rather the absence of dark streets and unlighted parks that measures the real excellence of her public lighting.

The stranger passing a week in New York for the first time will carry away

THE SPEEDWAY, LOOKING NORTH TOWARD THE FAMOUS "HIGH BRIDGE."



PELL STREET, THE HOME OF "CHOP SUEY."

many impressions that will linger long in the memory, but of these it is altogether probable that the most vivid, and the longest lived will be of those scenes in which artificial light is the chief element. There is darkness, and misery, and crime here, as in every gathering place of humanity—if one will seek them out, but they must be sought for; while light, and gaiety, and good cheer are so abundant that they can scarcely be evaded, and so largely in the ascendency that we may enjoy all of their stimulating and inspiring effects with a good conscience, knowing full well that there is more goodness and less degradation to-day than ever before in the world's history; and for these blessings light is entitled to a goodly share of the credit.

The lighting that is essentially spectacular is confined entirely to private enterprise; and this is as it should be. But of wonders in illumination maintained at private expense New York easily surpasses the world. The marvelous lighting of the Singer tower outshines the government light-houses, and is the first beacon to welcome the mariner by night. And with what can we compare the infinite lights of the only Coney Island? To see these, doubled by reflection and shattered into glittering fragments by the riffling waters of the sea, is to retain the glorious vision forever.

Fiat Lux

The black of aeons hung above the sweep
  Of countless, nameless Waters, as they lay
  Beneath the vault that ne'er had shed a ray
Of light—all silent lay, save but the weep
Of aching wastes that ne'er had known the neap
  Or spring of tide, that ne'er had felt the play
  Of winds upon its breast, nor tossed its spray
In glee, for naught was yet but Dark and Deep.

Then spoke The Spirit from the heart of Space,
  And, sudden, lambency slow spread along
    The far off reaches of the palsied Night,
And rosy fingers touched the Waters' face
  In tremulous caress—and lo! a song
    Welled up from out the Deep, and there was LIGHT!

Claribel Egbert.

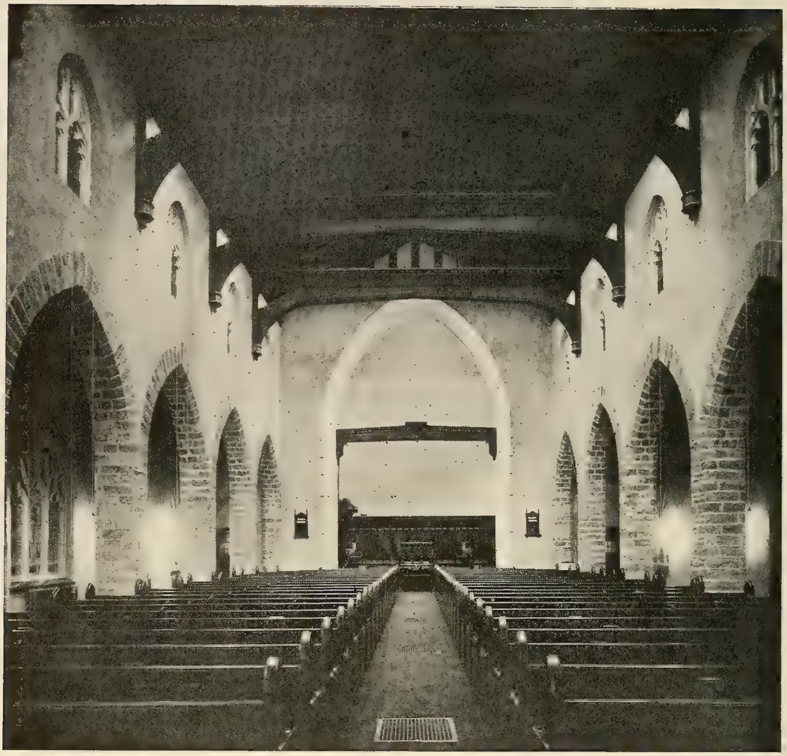


FIG. I.—SUMMIT PRESBYTERIAN CHURCH, GERMANTOWN, BY SEMI-INDIRECT ILLUMINATION.

Semi-Concealed Systems of Church Lighting

By Robert B. Ely and C. A. Ziegler.

The prime object in church lighting is for utilitarian purposes, and must be so designed and installed as not to be offensive to the congregation.

The churches that are now under construction and those of recent construction are receiving the careful consideration of the illumination scheme that is essential to meet the restricted requirements of the evangelical and ritualistic bodies.

Co-operation between the architect and the illuminating engineer will solve the problem, and this co-operation is becoming more evident every day.

In Fig. 1 is shown the interior of the Summit Presbyterian Church at Germantown, Philadelphia, Pa., illuminated at night. The church was designed by the architectural firm of Duhring, Okie & Ziegler of Philadelphia, Pa. The architectural scheme is an attempt to secure a true ecclesiastical spirit in a building of moderate cost depending on the proper proportion of the masses for effect rather than on the use of costly and elaborate detail.

The Building Committee for whom this church was erected desired a building that would follow the traditional church plan, producing an ecclesiastical effect not to be obtained in the auditorium plan, which is now much in vogue for Protestant churches. The nave has a seating capacity of 500, and is divided from the aisles by a series of arches and piers built of dressed local stone. Above the arches are clearstory windows providing excellent light and ventilation. Fresh air is brought

into the building through the indirect registers shown in the center aisle, and large ventilating registers opening into an air chamber back of the chancel arch keeps the air constantly changing. The choir is directly in back of the pulpit, with the organ to one side. As is usually the case, with a clearstory church, the acoustic properties are perfect.

The general illumination of the auditorium and nave is effected by the installation of 50 40-watt Mazda lamps, equipped with Holophane prismatic reflectors, installed on the chancel side of each truss, located at a height of 30 in. above the floor, and spaced as shown on the floor in Fig. 2. Each lamp is on an angle of 20 degrees from the vertical. The wires run in conduit on the face of the truss, and each outlet is terminated with a condulet and short rupple bent to the proper angle.

The rear of the auditorium is illuminated by six 40-watt Mazda lamps, equipped with sand blasted shades of artistic design, there being two three-light brackets located on the rear wall.

The choir is illuminated by six 60-watt Mazda lamps in an upright position equipped with conical metal reflectors. The lamps are on short brackets close to the wall of the chancel arch.

Each aisle is illuminated by 15 25-watt Mazda lamps on five three-light brackets equipped with sand blasted shades.

The lights in the aisles are the only lights within the line of vision, and the lamp, or source of light, is completely hidden from view and the illumination is toned down by a very heavily sand blasted shade.

By this semi-concealed direct lighting system a sunbeam effect is obtained, which gives a desirable shadow in one general direction, as can be seen in the photograph on the further side of the arches and the shadow of the pews on the floor.

The glass reflectors permit sufficient light to penetrate to the upper hemisphere to bring out the architectural features (more so than shown in photo). The congregation of this church is pleased with the results obtained.

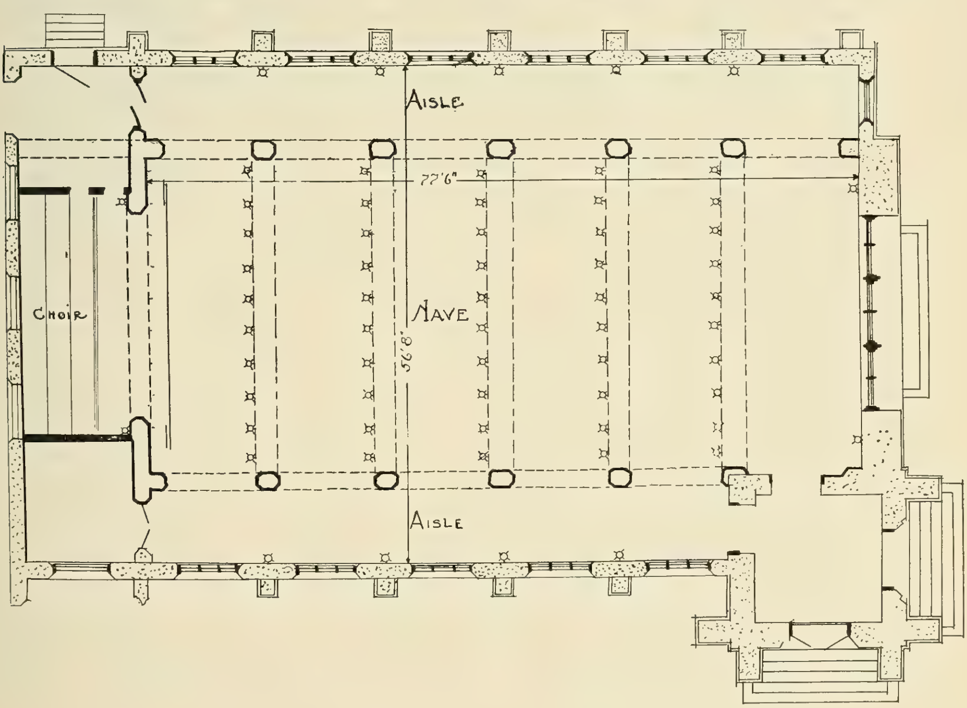


FIG. 2.—FLOOR PLAN, SHOWING ARRANGEMENT OF UNITS.

Photo by Oscar Pach.

FIG. 1.—MAIN ENTRANCE, NEW YORK PUBLIC LIBRARY.

The Lighting of the New York Public Library

The New York Public Library, being the most recent structure of the kind to be erected, with unlimited appropriations available, is naturally the most magnificent. It is a common saying in the country that you can always tell the newest church by picking out the one with the highest steeple, and the same spirit of rivalry exists in the construction of monumental buildings.

The Boston Public Library was famous in its time, and still so, for its architecture, and has also been characterized as the worst lighted library in the world. The Congressional Library in Washington was the masterpiece of its kind at the time of its construction, and remains to-day one of the most beautiful pieces of architecture in the world, and the Chicago Public Library is not without its pretensions in this respect.

It could hardly be expected that New York would permit itself to be outdone or equaled in the magnificence of a building for this purpose. Its new public library, which will be opened by the time this is in the hands of the reader, is one of the largest, most elaborate and extrava-

gantly constructed buildings which the world has ever seen. The artificial lighting of this building is, therefore, of more than ordinary interest, both on account of the character of the building and the purpose for which it exists. The word "library" at once suggests reading, which is admittedly one of the most exacting kinds of work that the eyes are called upon to do, and hence the illumination, which is the direct means by which the reading is accomplished, is of more than ordinary importance. Only a few typical installations showing the types of lighting fixtures can be shown in this article.

Fig. 1 is a view of the main entrance, which is on the Fifth avenue side of the building. As shown, the artificial lighting here is by candelabra, the standards of which are of marble, beautifully carved and polished, with arms of gilt bronze supporting the candles. The entire building is characterized by the extreme care bestowed upon every detail, the workmanship being of the very highest order of skill. This is but imperfectly brought out in the photograph. The elaborate carving on the candelabra is carried out with this characteristic spirit of accuracy and perfection. As the construction of both walls and ceilings is of white marble, the problem of illumination, with reference to distribution, is exceedingly simple.

Fig. 2 shows a portion of the exhibition room, where the rare books and manuscripts are on view. White marble is uni-

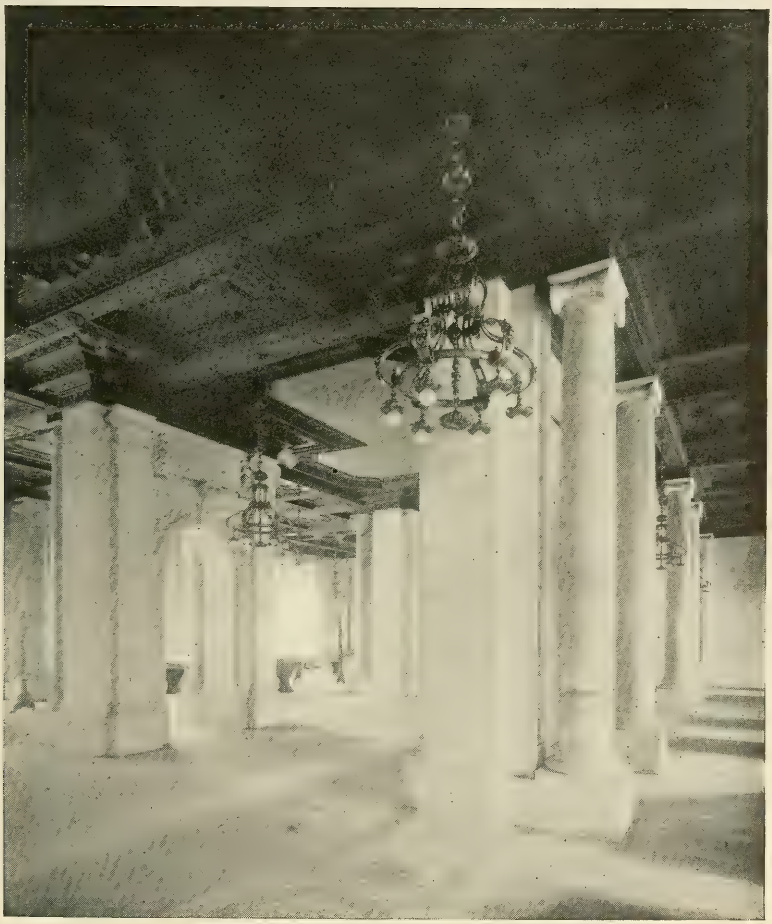


Photo by Oscar Pach.

FIG. 2.—A CORNER OF THE EXHIBITION ROOM.

Courtesy of the "New York Architect."

FIG. 3.—ONE OF THE COMMITTEE ROOMS.

form throughout the building, but the ceilings differ in material and decoration; the ceiling in this room is of oak, carved in the most elaborate manner. The fixture shown here is used to a considerable extent throughout the building, and is of bronze, finished with pure matt gold.

The illustration on the front cover panel is a view of the main reading room. This is undoubtedly the largest reading room in the world, being 300 feet in length and 75 feet wide, and through the middle of the room is an architectural structure over the delivery tables. The fixtures here are of bronze, supporting spherical frosted lamps. The tables, incomplete as shown in the photograph, are equipped with individual table lamps, fitted with round shades.

Fig. 3 is a view in one of the committee rooms. This is one of the smaller rooms, and the furnishings are of a less massive order than in the larger rooms, and the lighting is by a central chandelier, finished in dull gold and fitted with electric candles. Side brackets similarly equipped are also used.

The massiveness of construction throughout the building, if carried out in the lighting fixtures, as some have maintained should be the case in order to produce the requisite harmony, would have furnished unusual opportunities for the construction of monumental bronze work. But the architects have taken the view that the lighting fixtures are not architectural, and, while they are by no means of light construction or petty in appearance, they have not been unduly overloaded with metals. The proportions have been well kept and their merit lies in the exquisite workmanship and good design rather than in weight. The more ornate fixtures use no shades at all, round frosted lamps serving as light sources. In the less decorative fixtures plain lamps and opalux reflectors are used. The fixture installation is by the Sterling Bronze Company.

The book stacks occupy the central portion of the building on the Bryant Park side. The lighting of these stacks, as originally planned, consisted in the use of 16 c.-p. lamps attached to the ceiling of the aisles. This was found inadequate, and the necessary additional lighting has been provided by the use of lamps in special reflectors designed by I. P. Frink. As these were not contemplated in the planning of the stacks, but had to be designed so as to accommodate themselves to the exigencies of the case, it presented an illuminating engineering problem demanding unusual mechanical skill, as well as practical illuminating engineering. The result is very successful.

Suggestions for Conserving the Eyesight of Children

By F. Laurent Godinez and Albert Jackson Marshall.

When we consider that a child's eyesight is at its best during the sixth year, it seems quite illogical that at that time we should subject these little ones to what is termed the short focus. I have in mind an arrangement whereby the schoolroom seats are placed in such a manner as to give each occupant an uninterrupted view of one or two blackboards. At the age of six a child does not require an encyclopedia in portable form, and it has occurred to me that if the daily "lessons" were printed on these charts the long focus would insure an ideal condition of absence from eye strain. If a pupil required lenses there could be no better way of discovering his weakness than by introducing such a plan as I have outlined. Perhaps it might not be superfluous to add that the charts should be carefully prepared on depolished paper in order to avoid glare.

As the child approaches that stage where text-books become necessary I recommend that such books be prepared and printed on India paper. This would enable larger type to be used with a greater space between lines, and that without increasing the size or weight of each volume. I believe that every one is quite familiar with the qualities of this India paper, which has recently been brought before the public in the publicity relative to a new edition of the *Encyclopedia Britannica,* but to emphasize the relative thickness of two volumes, one printed on ordinary paper and the other on India paper—the ordinary is two and three-quarters inches thick and the India paper actually less than one inch. The expense of printing text-books in large quantities with India paper would hardly exceed the present cost. This paper is opaque in spite of its extreme thinness, and moreover lends itself readily to the "flexible binding" so desirable in reference books. It is generally admitted by opthalmologists that such systems of artificial lighting as produce pleasing contrasts, whereby pupilliary variation is obtained are highly desirable.

We cannot, of course, obtain variation of the pupil without accompanying muscular activity in those muscles which control such action. In several tests recently conducted I have found subjects who complained of their inability to indulge in continued reading at night, and were greatly benefited by slightly varying the intensity of their reading page. This naturally produced corresponding pupilliary variation, which, while slight, served the purpose of relieving the fixed muscular tension of those muscles regulating the pupilliary diameter, and thereby eliminating the inevitable reaction accompanied by its invariable sensation of physical discomfort. I have previously stated in other articles the advisability of alternating illumination, and at present I feel that the subject merits the grave consideration of all those interested in the conservation of vision movement. Where the variation of intensity on the page cannot be accomplished by manipulation of the light source, it may be effected by slightly tinting every other five pages a light neutral grayish tint. Thus, with a fixed intensity, the amount of light reflected to the eye of the reader is successively varied enough to produce such pupilliary changes as are beneficial and desirable.

Ornamental Street Lighting a Luxurious Necessity

By C. L. Eshleman.

Civic pride and municipal competition have been responsible for the development and installation of ornamental lighting systems. Civic bodies, municipal associations and business men's clubs have been eager to do something for their cities that would attract attention and place them in a class just a little above their neighbors.

Ornamental lighting at once appealed to them as an effective and comparatively inexpensive means of accomplishing this purpose. In many cases immediate steps were taken to institute ornamental lighting campaigns, but it was found that they were long-drawn-out affairs, because the members of these bodies were not thoroughly familiar with electrical conditions and many of the technical points entering into a comprehensive lighting scheme.

These early campaigns were only indifferently successful, until the co-operation of the local central station was obtained.

For two and one-half years the writer has contended (in the face of considerable criticism) that the central station was the logical interest to engineer propositions of this nature, on account of their familiarity with local electrical conditions and their close relationship with the business interests involved. Hundreds of lighting companies have recognized the possibilities and the progressive ones have grasped them in a manner little less than amazing.

Popularity.

Public popularity may be attributed to four causes:

1. The important part that an ornamental lighting system plays in the popu-

FIG. I.—ORNAMENTAL LIGHTING, MAIN STREET, EVANSVILLE, IND.

FIG. 2.—FLAME LAMPS, NORTH UNION STREET, PUEBLO, COLO.

lar movement for the City Beautiful—artistic as well as utilitarian.

2. The advertising value to the city as a whole an indication of its prosperous condition and progressive spirit—a well dressed city, like a well dressed man, commands attention and respect.

3. The benefit in dollars and cents accruing to the business interests in the lighted district. The value of property on a business street is directly proportionate to the number of people who make use of the street as a thoroughfare—light attracts people.

4. The increase in downtown property values and decrease in crime.

Furthermore, from the central station standpoint the installation of an ornamental lighting system has proved a great opportunity.

1. Every standard installed means the addition of one-half k. w. to the lighting load, or a definite return of so much per front foot for the lighted district. This

FIG. 3.—FLAME LAMPS, SOUTH UNION STREET, PUEBLO, COLO.

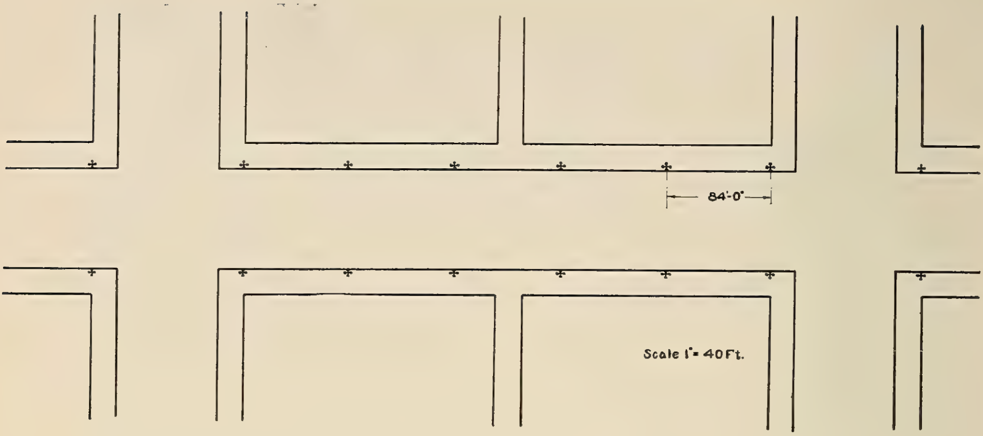


FIG. 4.—SPACING OF STANDARDS.

is a dollars and cents opportunity.

2. The installation of a comprehensive lighting system means a return in good will and advertising that cannot be measured in dollars and cents. This is an opportunity in disguise.

3. Such an installation reflects credit upon the city, pleases the people, increases business and begets a desire to improve the general lighting of the entire city.

Successive Developments.

Although so-called "ornamental lighting" has been in vogue for many years, it has remained for the past year to bring about definite and positive developments in this line. Before passing to a detailed description of present street lighting practices, it might be well to take a casual glance at several forms of lighting that have been popular in past years. Successive developments in underground service have brought about successive developments in decorative lighting. Approximately ten years ago the change from overhead wiring to underground brought about the change from inclosed arc lamp span or center street suspension to suspension from more or less ornamental shepherd's crook poles. A number of notable installations placed at that time are still in service.

Festoon and Arch Lighting.

Following the pole suspension of inclosed arc lamps, we find the growing popularity of the festoon system. This consists of a carnival effect produced by stringing streamers of incandescent lamps either across the streets or parallel to the curb lines. Streamers were installed to produce a spectacular effect during a short period of festivity and then removed.

The festoon idea naturally developed into a more permanent system in the form of steel arches suspended across the main business thoroughfare. Installations of this nature produced definite night results, but the effect by day was not altogether pleasing. An ornamental lighting system must be esthetic as well as utilitarian.

Much might be written about these older forms of spectacular lighting, but time and space will not permit an exhaustive review of what has gone before. We might say in passing that they were all stepping stones to better things, and those who originally conceived the ideas and put them into effect deserve as much credit as those responsible for present systems. We must bear in mind that the tools with which our forebears had to work—inclosed carbon arcs and carbon incandescents—were somewhat crude and demanded the treatment that they received.

Present Systems.

The advent of high efficiency arc and Mazda and tungsten lamps has revolutionized outdoor as well as indoor lighting and has opened up worlds of possibilities. These high efficiency units make

FIG. 5.—ORNAMENTAL STANDARD FITTED WITH OPAL BALL GLOBES.

it possible to produce not only spectacular but highly ornamental effects—the production of illumination instead of simply light, the substitution of glow for glare.

An analysis of present business district lighting reveals two definite forms of installation:

1. Flame lamp or high efficiency metallic electrode lamps, suspended from ornamental shepherd's crook poles.

2. The Mazda or tungsten cluster or ornamental standard system.

It is not our intention in this article to say that one system is right and the other wrong, but simply to outline in a general way the effect produced by both and leave our readers to decide which form they desire. Following Emerson's statement that " ideals is largely a matter of geography," we will say that the installation of an ornamental lighting system is largely a matter of personal taste. We will further say that both of these systems are good and both have come to stay.

Up to this point we have endeavored to show four things:

1. That there is an unmistakable demand for a substantial system of ornamental street lighting.

2. That the central station, through its new business department, is the logical interest to satisfy this demand.

3. That an ornamental lighting system pleases the people and at the same time is profitable to the lighting company.

4. That this business has passed the pioneer stage and that there are two "come to stay" forms: (A) high efficiency arc lamps, (B) ornamental Mazda or tungsten standards.

HIGH EFFICIENCY ARC LAMPS.

Space will not permit a detailed description of the effective magnetite installations in St. Louis, Toledo, Detroit, etc., but we will quote from an interesting

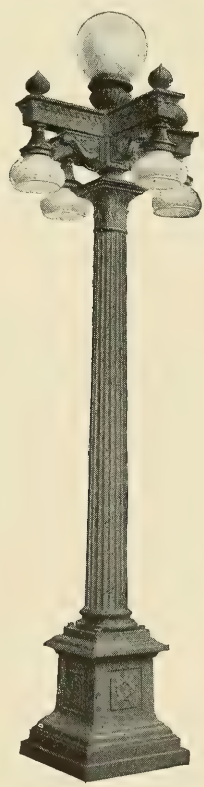


FIG. 6.—ORNAMENTAL STANDARD FITTED WITH HOLOPHANE PRISMATIC REFLECTORS AND OPAL ENCLOSING ENVELOPE.

FIG. 7.—ORNAMENTAL LIGHTING, HAMILTON, ONT. KING STREET, EAST FROM JAMES STREET AND GORE PARK.

article written by Mr. E. J. Stone, superintendent of lighting and power of the Pueblo & Suburban Traction & Lighting Company:

"THE GOLDEN WAY OF THE WEST.

"More than a Mile of Flaming Arc

"Lamps in the Business District

"of Pueblo, Colorado.

"Pueblo's ornamental street lighting is unsurpassed, having the greatest volume of light for the least expenditure of construction and operation.

"The installation consists of regenerative flame arc lamps, working on a 110-volt alternating current at 7 amperes each, burning seventy hours on one trimming. The lamps are placed approximately 135 ft. apart and opposite each other on both sides of the street. The lamps are supported by gooseneck fixtures made as pole

FIG. 8.—ORNAMENTAL LIGHTING, HAMILTON, ONT. JAMES STREET, NORTH FROM KING STREET.

top extensions, overhanging the street 2 ft., on iron trolley poles that were already in service for the trolley lines.

"The cost of installation was borne by the Pueblo & Suburban Traction & Lighting Company at $65 per light, which includes lamps, pole top fixtures and all construction. The transformers supplying the entire installation are on a separate primary circuit and by this method we get station control. The cost of operation is borne by the merchants at $72 per lamp per year, netting approximately 3½ cents per kilowatt for all current consumed.

"The plans for special lighting were first submitted to the South Union avenue merchants, who selected a committee to assess each merchant and collect the required amount as an advance payment for the cost of operation for one year. The merchants responded admirably and the money was raised with great ease.

"Similar plans were submitted to the North Union avenue, Main street and Fourth street merchants, which were readily accepted, so that now we have more than a mile of magnificent lighting.

"The intensity of the light given by the lamps necessitates the lamps not being hung less than 24 ft. from the ground, depending upon the width of the street, which makes the average trolley pole suitable for this kind of construction.

"This system of special street lighting has many advantages that others have not, due to the fact that the flame arc lamps are hung higher, giving a golden-yellow ray of light which is stimulating in character and very pleasing to the eye. The color and height of the light does not detract from the window lighting, but rather tends to make the street and window lighting more attractive.

"Special street lighting by means of flame arc lamps is cheaper and gives higher candle-power per watt than any of the other systems, which places the above mentioned system first in brilliancy and inexpensiveness."

Ornamental Mazda or Tungsten Standards.

This form of ornamental lighting has proved remarkably popular during the past two years, and has done more toward bringing to a realization the modern "City Beautiful" than any other element entering into the general civic movement. This statement applies more particularly to business district improvement or civic improvement by artificial means and is secondary only to the development of the city's natural resources, such as parks, driveways, streams, etc.

The ornamental lighting movement carries the unqualified indorsements of the officers and active members of the American Civic Association and other societies interested in improving American towns and cities.

In addition to the manifest advantages already enumerated, we have permanence, beauty by day and night, even distribution of light (not a gaudy or vulgar display), low installation and maintenance cost and dignified advertising.

Improvement by ornamental standard lighting is alike within the reach of the small town and large city. The writer has before him a photograph showing an installation in a town having a population of less than 1000. Many of the buildings on the main business thoroughfare are modest to the point of being poor and really are subordinate to the installation itself, yet we must recognize the progressive spirit displayed by the business interests of this small town. Theirs is an example of civic betterment that can advantageously be applied to larger and richer municipalities.

Without further generalizing, let us pass to a more detailed study of the practical phases of ornamental standard lighting.

Types of Standards.—Three and five light standards are common in smaller cities; five-light standards are installed on street corners, three-light between. In larger cities five-light standards are installed throughout.

Glassware and Lamps.—One-light upright fitted with 16-in. globe and two or four lights pendant fitted with 12-in. globes is common practice. There are some installations in which all lights are upright. In the former the top unit should be a 100-watt lamp; pendant units should be preferably 100-watt, in no case less than 80-watt. Above recommendations cover lamps inclosed within opal,

FIG. 9.—FLAME LAMPS ON A PITTSBURG CORNER.

opalescent, alabaster, alba or sand blasted balls.

During the past year there has developed a scientific unit, consisting of a Holophane prismatic glass reflector covered with an opal envelope. In this unit the reflector distributes the light in the proper downward direction, giving the maximum of illuminating efficiency, while the envelope serves primarily to give decorative value and prevent dust and dirt from collecting on the prismatic reflector.

The function of this unit, to give light on the object, not on the eye; in other words, the prevention of glare, is a commendable one. It is claimed that the same foot-candle intensity of illumination on the street and sidewalk can be obtained by using 40 or 60 watt Mazda or tungsten lamps in this unit as is possible with 100-watt in diffusing balls previously referred to. It is further stated that the increased first cost is offset in from ten months to a year by the saving in current supplied to the lower wattage lamps.

Spacing of Units.—Fifty to 100 ft. is common practice, 50 to 60 ft. spacing giving excellent illumination; 70 to 80,

FIG. 10.—WASHINGTON STREET, INDIANAPOLIS. A MILE OF STANDARDS.

good; 90 to 100, fair. With standard 60 to 66 ft. streets, units should be placed opposite each other and spaced 60 to 66 ft. apart on both sides of street. On wider streets units should be spaced correspondingly closer. The following is a general rule that can be followed to good advantage: "The spacing of lighting units should be inversely proportional to the width of street." In small cities and towns, having comparatively narrow streets (30 to 50 ft. in width), good results can be obtained by staggering the lighting units, the distance between units on same side of street being 90 to 120 ft.

Underground Service and Control of Standards.

Local conditions vary so greatly that it is practically impossible to give definite recommendations on this point. The following are representative of common practice:

INDIANAPOLIS, IND.

Connections are made through a 4-in. tile set 1 ft. under the gutter and 1 ft. from the curb, through which is run a three-wire lead covered cable. Double throw switch is located in a corner standard, and controls one entire block. This double throw switch in three-wire system permits of four lamps being turned off at 12 p.m., leaving the top lamp burning all night. Wires heavy enough to permit of flat rate window and sign lighting on the same circuit should be used. Standards turned on and off by patrolman.

DES MOINES, IOWA.

Each standard is connected to ordinary iron conduit led under the walk to the nearest service line. Each standard is controlled by its own switch in base.

HAMILTON, ONT.

As all lines are overhead, the circuits for these standards are run from transformers situated in the center of each block. Circuits contain three wires and are run down the pole in which the transformer is located, thence through conduit to the nearest standard, and from there distributed to different standards in that particular block in conduit placed about 3 in. below the surface of the pavement near the curb. The lamps in each block are controlled by a switch placed in the base of the standard nearest to the transformer pole. Standards are turned on and off by patrolman.

GARY, IND.

Wired series No. 10 standard insulated for 6600 volts, cable is No. 6 insulated, 7-32 in. rubber, 3-32 in. lead. Enters G. W. Pothead at condulet box at base of standard.

Total First Cost Standard and Underground.

Total first cost depends upon method of wiring, service, connections, spacing of standards, type of standards and other variables too numerous to mention. Each individual case must be handled on its merits. First cost of standards ranges from \$25 to \$60 each, underground and connections \$20 to \$50 each. On basis of 60-ft. spacing, total installation charge ranges from 75 cents to \$1.80 per front foot.

Average Hours of Burning.—Dusk to midnight, 2000 hours per year.

Average Cost of Maintenance.

Globe renewals per post per year......	\$4.00
Lamp renewals per post per year......	10.00
Painting per post per year............	.50
Current per post per year at $1\frac{1}{2}$ cents per kilowatt hours..................	15.00
Miscellaneous	.50
Total..................................	\$30.00

Revenue.—Depends entirely upon foot front assessment, which in turn is based upon total first cost of standards and underground. We previously stated that each case is special, consequently no two companies will make the same charge. In general, it is true that the foot frontage system of charging is the proper one. It has been found that the ground floor tenant is too uncertain a quantity, consequently a contract should be executed with the city, property owners or merchants' association for the installation and maintenance of standards.

FIG. I.—ORNAMENTAL STANDARDS INSTALLED AT LANSING, MICH.

A Municipal "White Way"

Among the comparatively few successful municipal lighting plants, that of Lansing, Mich., must be numbered. Without going into an analysis of the financial reports and tracing out bookkeeping balances, it is safe to say that any lighting corporation, municipal or otherwise, that makes a general clean-up of antiquated methods of lighting and installs a new and modern system is entitled to be called "successful"; and this is what has been done in the Michigan city. In place of the old-time arc lamps in the business section new decorative lamp standards with supporting clusters of Mazda lamps in Alba glass balls have been installed. These posts are regarded not only with satisfaction, but pride, by the citizens who, according to the local press, are more pleased with the new lighting than with any other municipal improvement.

"As one good turn deserves another," it is said that the initial installation of this decorative lighting is a death warrant for all of the old arc light illumination with its system of overhead wiring. That is one of the greatest advantages of the new public lighting; when once a start is taken it is sure to spread until a city well lighted throughout results; and if there is one public improvement more than another that the people will support and praise, it is good lighting. Its benefits are universal and too conspicuous to be ignored.

The original installation included twenty blocks, on which were placed two hundred and sixty-three posts, the corner post containing five lights and the intermediate posts three lights each, the posts being placed 60 ft. apart. The lamps are 60-watt Mazda; the globes, Alba glass. A portion of the posts are finished in black and other in aluminum. All lamps are burned until midnight and the center lamp the balance of the night.

FIG. I.—CONCERT HALL, ROYAL YACHT CLUB, KIEL.

Some Interesting Examples of Lighting Practice in Germany

BY R. F. PIERCE.

German practice in the design and use of electric lighting fixtures is of interest, not as furnishing a source of ideas for American designers to copy and engraft upon an already heterogeneous and unoriginal native school, but as a source of inspiration toward the development of a distinctly American school of design expressive of American thought and ideals.

For many years progressive American architects have deplored the present tendency to adhere to the established orders, with such modifications as the exigencies of the case may require. It is quite generally accepted that the evolution of a distinctly American architecture must come from within, not from without, and that the limitations imposed by the classical orders are too entirely foreign and unmodern ever to serve even as a basis for a newer and distinctively native school.

While the touch of the German designer is undoubtedly heavy, and his taste and judgment seldom either delicate or accurate, yet the modern German designers have been markedly successful in the founding of a thoroughly German school of design, which is vigorously expressive and remarkably free from the incubus of tradition.

The results show very plainly that available sources of inspiration have by no means been exhausted, and that a real opportunity exists for the development of a purely American school of design, which shall be founded on the needs and expres-

FIG. 2.—SEMI-INDIRECT LIGHTING, UNIVERSITY OF JENA.

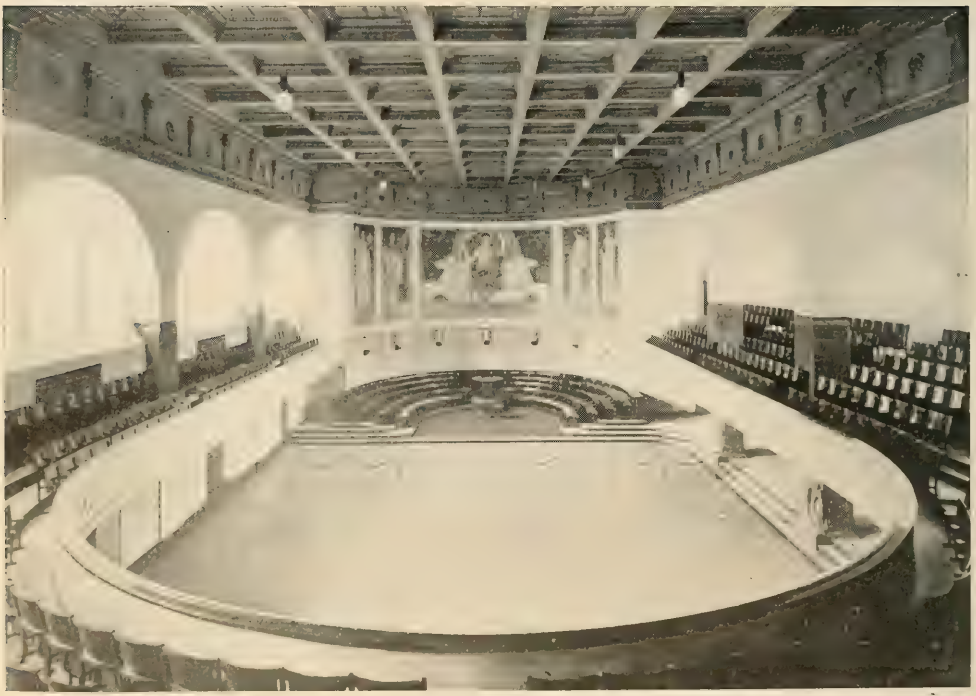


FIG. 3.—FLAME ARC LAMPS FOR LIGHTING A LARGE AUDITORIUM.

sion of the ideals of the American people.

In Fig. 1 the Concert Hall of the Royal Yacht Club, at Kiel, a typical instance of the German designer's handiwork is shown. It is obviously Teutonic in its solidity and heaviness, and shows much evidence of the influence in Germany of L'Art Nouveau. It is, however, to say the least, strikingly original in conception and treatment.

Fig. 2, while embodying nothing in the way of fixture design, is given as an illustration of the semi-indirect lighting systems which are much in vogue in Germany, but have made little progress in America. The units generally used are 5 ampere semi-inclosed arc lamps using small carbons (7 to 8 mm.). These units have a specific consumption of about ¾ watt per m. l., hem. candle-power, and are thus much more efficient than metal filament incandescent lamps. The semi-indirect system permits the necessary "sense" of "direction" of the illumination to be obtained and at the same time *uniform* illumination of the ceiling. It is favored much more than the totally indirect system in Germany.

Fig. 3 illustrates the use of flame arc lamps for lighting auditoriums, etc., and contains, of course, nothing of interest to the fixture designer, but is given as an instance of the interior application of this illuminant.

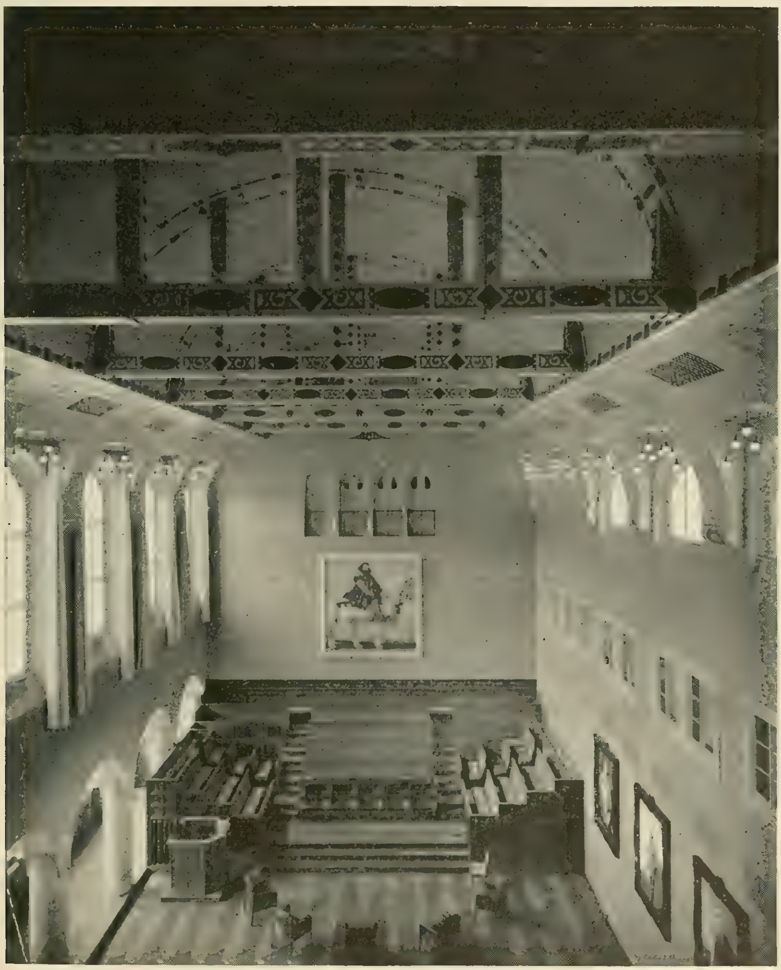


FIG. 4.—CLASSROOM, UNIVERSITY OF JENA.

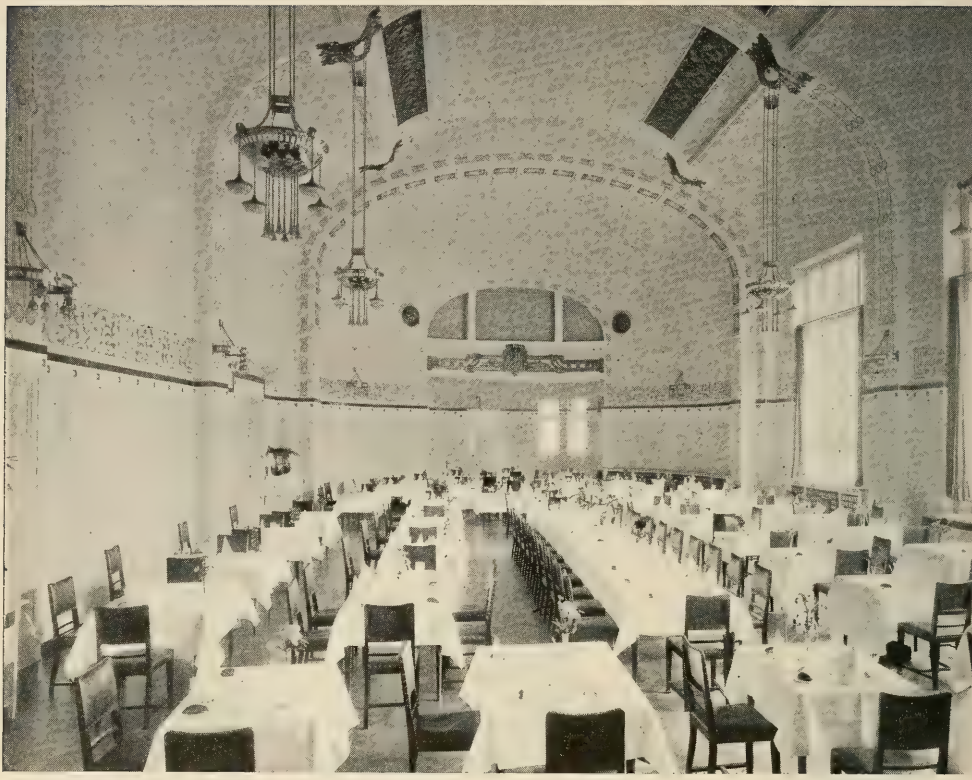


FIG. 5.—A GERMAN BANQUET HALL. A STUDY IN HARMONY OF CURVES.

Fig. 4 shows a most unconventional yet wholly pleasing scheme of lighting and decoration. This classroom at the University of Jena is lighted by tantalum lamps placed at the tops of the windows, simulating daylight in direction and detracting not at all from the effect of the interior, as would be the case if chandeliers were used. The whole interior being of almost monastic simplicity, the ostentatious presence of artificial illuminants would be decidedly inharmonious.

Fig. 5 shows a striking and wholly artistic installation in which the cusps of a three-lobed arch are utilized for the suspension of the lighting fixtures. Both the manner of suspension and design of the fixtures are worthy of notice as indicating how a difficult problem was happily solved. The effect of this interior is thoroughly harmonious, and excellent taste is shown. The treatment is thoroughly modern, and there is nowhere in evidence the slightest hint of the traditional or conventional, yet it is unmarred by any error of taste or judgment.

Many of these installations contain very definite hints to the architect of methods by which the deadly monotony of the "usual" may be avoided without stepping at the same time into the pitfalls which beset the path of him who seeks to avoid the beaten track. Original they surely are, yet, in the main, expressive of excellent taste and faultless design. It appears likely that a national school of decorative art is further developed in Germany than in any other country, and that this development has been thorough is shown by the extent to which it has influenced what is, in America, the purely commercial field of fixture design.

The Development of Street Lighting Fixtures

By H. Thurston Owens.

For the past five years the question of appearance and utility in street lighting fixtures has received attention second only to that of the modern types of lamps which have been placed in commercial service. In the large cities underground construction has been largely extended and has been introduced on the main streets and many of the smaller ones. This change has included new fixtures and new lamps.

Merchants' Lighting.

The expense of remodeling a street lighting system is a large item, and in the majority of instances the merchants have been called upon to contribute, either to the construction or to the maintenance account.

FIG. I.—STANDARD RECENTLY ADOPTED BY LIGHTING COMPANY AT BROOKLYN, N. Y.

FIG. 2.—TYPE OF STANDARD ADOPTED BY THE CITY OF ELMIRA, N. Y.

The first city to adopt this so-called merchants' lighting system on a large scale was Los Angeles, Cal., and the method used has been the most successful of any, although it has seemed to be a departure too radical for Eastern cities to follow. The contributions of the merchants are collected by the city and become a lien, the same as taxes or water rates.

The tower system of arc lighting was in use, when it was decided to light the

FIG. 3.—ONE LAMP STANDARD AS ADOPTED BY THE CITY OF WASHINGTON, D. C.

main streets in a more attractive manner, and five-light standards with carbon incandescent lamps were used to replace the old system.

The next large installation was at St. Paul, Minn., and in both cases all of the globes are placed upright. Shortly after the introduction of the Mazda and tungsten lamps the interest in this form of lighting was increased one hundredfold, and in order to utilize a greater portion of the light upon the surface of the street, four of the globes were hung pendant and one upright. This type, shown in Fig. 1, has recently been adopted by the lighting company at Brooklyn, N. Y.

These posts are to be used for private lighting installations, the city's requirements being that the lamps be placed at least 10 ft. 6 in. above the pavement, and that one lamp burns during the full city schedule.

A much simpler type of ornamental cluster, shown in Fig. 2, has been so constructed that the lamps can be placed either upright or pendant, but none seemed to have been called for in the former position. This type has been adopted at Elmira, N. Y.

The tungsten lamps used on all iron equipment for park lighting for the city of New York have been placed in a lantern with clear glass outer globes, with a reflector above the lamp, being somewhat similar in appearance to the naphtha lamps which they displaced.

The iron Mazda or tungsten posts are not only more attractive in appearance than the gas posts, but are made stronger and have a machined instead of a lead joint. Should it become desirable to increase the height of these posts same could be readily done. This is not true of the

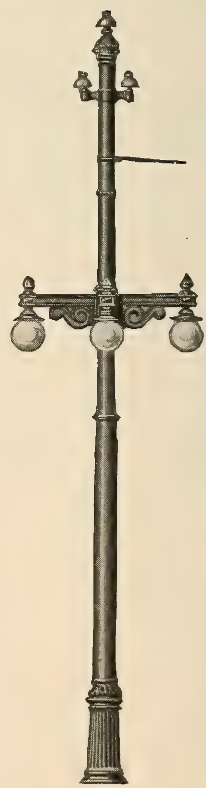


FIG. 4.—COMBINATION LIGHTING AND TROLLEY POLE ADOPTED BY THE CITIES OF POUGHKEEPSIE, N. Y., AND LINCOLN, NEB.

FIG. 5.—LUMINOUS ARC LAMP STANDARD ADOPTED BY THE CITY OF DALLAS, TEXAS.

gas posts, however, which has been one of the reasons why the inverted type of gas burner has not been used to any large extent up to the present time.

The First One-Light Mazda or Tungsten All-Iron Equipment for Street Lighting.

A lamp-post of modern construction has recently been adopted by the city of Washington for street lighting, the lamp in this case being placed in a diffusing globe. This is shown in Fig. 3. This is the first large installation of single Mazda or tungsten lamps on iron poles for regular street lighting in the country.

Another type of fixture which has come into vogue where Mazda and tungsten lamps are employed is the combination of trolley and lighting pole. The type adopted at Lincoln, Neb.; Poughkeepsie, N. Y., and a number of other cities is shown in Fig. 4.

While the cluster type of ornamental lamps has been used much more extensively than any other type, flame, luminous, inclosed and open arc lamps have been used for a number of important installations.

Single luminous arc lamps have recently been adopted by the city of Dallas, Texas, the fixtures being illustrated in Fig. 5. The same type of lamp, with one, two or more lamps to the post, has been adopted at Boston, Mass.; St. Louis, Mo.; Baltimore, Md.; Toledo, Ohio, and many others.

Twin flame lamps were first adopted at Newark, N. J., and this system has been extended to a number of other cities. Both single and twin inclosed arc lamps, with diffusing globes, are used in large numbers in the city of New York; nearly 15 miles of highways being so lighted. Twin open arcs, with diffusing globes, have been installed in large numbers in the city of Philadelphia.

The editor of this publication recently prophesied that the life of an illuminant did not exceed ten years, and there is no doubt that the method of having merchants pay for part of the public lighting is one which will only have a life of ten years also.

Municipalities benefit sufficiently to pay for all of this so-called *lavish* lighting, and as we progress, these installations will no longer be called lavish and the standard of street lighting will demand that the city supply such installations.

Another reason for this change is undoubtedly due to the fact that, as the present short term of contracts lapses, less attention will be paid to the maintenance of the posts, which in itself should be sufficient reason for any city to take them over.

FIG. I.—A SECTION OF THE UNITED ENGINEERING SOCIETY'S LIBRARY, NEW YORK, BY INDIRECT ILLUMINATION.

Indirect Lighting in a Library

In the first years of illuminating engineering the proper method of lighting a library reading room was considered to be one of the few problems which had been finally solved. The table lamp, equipped with a green and white glass shade, with a little general illumination from the traditional chandelier, was considered as nearly perfect as any method of artificial lighting could be. The development of indirect illumination, which has been making great strides within the past two years, and more especially within the past year, has brought out the fact that this system is capable of producing a general illumination for these cases, which render the use of the table lamp entirely unnecessary. The most complete installation of this kind at the present time is that in the John Hay Library of Brown University, Providence, R. I., in which a reading room, 100 ft. long and 60 ft. wide, is lighted entirely by the indirect method without the use of a single table lamp.

Fixtures and Accessories

Some Western Ideals in Fixture Design

Geographically, the term Western has a very elastic meaning. To a large number of people, however, "Western" means anything beyond the Allegheny Mountains. Surely Chicago would not be averse to being classed as "Western," if, in fact, she would not consider it an actual compliment. The metropolis of a country naturally arrogates to itself supremacy in all things, and especially those things which apply to the higher phases of life. It is only three or four

FIG. 1.

FIG. 2.

generations ago that anything American was considered outlandish to the European, and any attempts at original art or literature in the wilds of the new continent was looked upon with a smile of indulgent pity. The average Easterner, and particularly the New Yorker, has something of this feeling of self-satisfied superiority relative to the efforts of "the

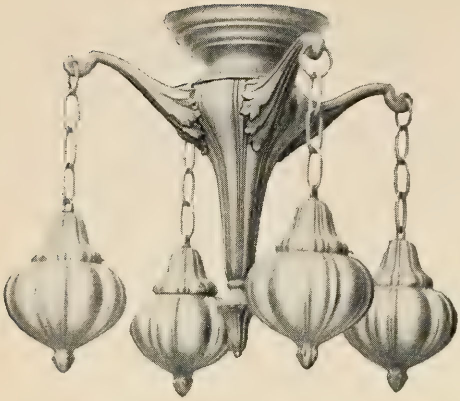


FIG. 3.

West," which is to him at best but a region of "hustling" pioneers.

But just as this country as a nation has advanced by reason of its freedom from Old World precedence and prejudices, so the West is advancing because of its freedom from the restraint of custom which has already fastened itself appreciably upon the older section of the East. The only serious attempts at the creation of new types of architecture have been matured within this "woolly" portion of our map, and a very interesting discourse might be written upon the political reforms which have sprung up under the same environment. A serious study of the artistic development of this section in whatever form expressed is therefore not to be despised.

This may suffice as the *apologia* to an examination of some recent examples of Western fixture design.

We may first remark that the Western designers are the only ones that have given any appreciable attention to Art Nouveau principles. Although their attempts in this line have been rather timid, they are nevertheless worthy of notice. In Fig. 1 we have a chandelier which shows distinct Art Nouveau tendencies in the form of the links of the chains and the supporting arms. The glassware also carries out the same motive. The general composition of line is excellent, the total effect being that of grace with appropriate strength.

Fig. 2 is another chandelier which, as a whole, must be classed as Art Nouveau. The general harmony of line in this case is the chief artistic feature, the proportions being exceedingly well kept. The canopy is a somewhat discordant note, but this is a defect which is easily remedied.

Fig. 3 is a ceiling fixture which must be classed as "modern," if not distinctly, Art Nouveau. The proportions are admirably worked out, and the harmony between metal and glass is complete. There is ample strength without clumsiness, while the flowing lines of decoration on the arms give a decided feeling of freedom in the motive. It is a distinctly good piece of work.

Fig. 4 is another ceiling fixture which embodies the principles of a style of architecture that has become fairly familiar in Chicago, but has not found its way east of the Alleghenies, at least to any extent. The design is very decisive in its motives, and would scarcely be fitting in any other surroundings, except those in which the same motives were in evidence. It is noteworthy as a successful effort to embody the ideals of this architectural novelty in the form of a lighting fixture.

Fig. 5 is a fixture of the "shower" type, which has come into great popularity within the past two years. The chief distinction in this case is the decorative form of the chain, which is a welcome variation from the simple mechanical links commonly used.

Fig. 6 is a chandelier embodying a distinct variation of the square construction which became popular with the introduction of the so-called "Mission" school of

FIG. 4.

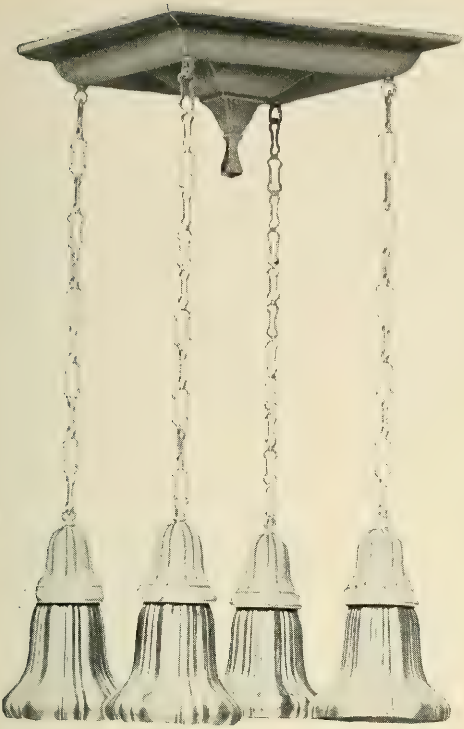


FIG. 5.

furniture design. The reeding of the corners of the tubing and the extension of the same contour into the canopies and shade holders combine to give a feeling of grace to the fixture which is decidedly lacking in the box-like, square construction.

Fig. 7 is a chandelier depending upon rugged strength as its chief motive, and yet which is sufficiently relieved by the few touches of decorative curves, such as those of the supporting hooks of the fixture and the lamps, to distinguish it from a purely mechanical construction; it carries out the idea of simplicity without being ostentatiously plain.

Fig. 8 represents a quite distinct type of fixture which has found considerable favor in the East. The variation of the shape of the canopy adds much to the general effect. The fixture is particularly susceptible to silver or gilt finish, and while graceful in itself will harmonize with a considerable variety of architecture and furnishing.

The examples shown, which are taken from the regular catalogue of a Western manufacturer, prove that New York and the East have no monopoly on artistic feeling as expressed in lighting fixtures.

A general observation of these fixtures, aside from any critical analysis of the motives of design, impresses the fact that has been increasing in evidence for some years past of the tendency to greater simplicity and purity in decorative art. To cast or spin a piece of metal and then overspread it with meaningless filigree or crude modeling and give the whole a coat of glaring gold lacquer is a practice that is happily passing away with the gaudy chromo and the brilliant green-and-red carpet.

" Beauty unadorned " is unquestionably the higher type, but to the extent that adornment is omitted, the lines of beauty must be the more distinctly and purely esthetic. Elaboration, even though skillfully done, soon palls upon the senses, and if unskillfully done, becomes positively ir-

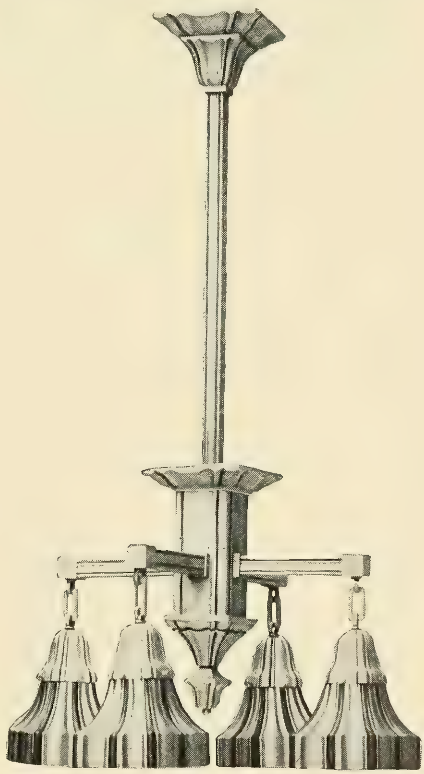


FIG. 6.

FIG. 7.

ritating. Simplicity, on the other hand, is always acceptable company, even though it lacks some of the graces of art.

But let not the uninitiated imagine that simplicity in art means cheapness in execution. Nothing is cheaper than florid embellishment, for its very intricacy of detail is a cloak that may cover innumerable sins of workmanship and material. The most difficult thing to make in this world is a perfectly plane surface; so difficult, in fact, that a surface that is approximately plane in absolute language is almost priceless. The same principle applies in the construction of lighting fixtures, whose art depends upon flowing curves and a softly modulated contour. Unless these lines are unbroken and the surfaces mathematically correct within the limits of ordinary vision, the faults of execution are glaringly apparent.

It is in this greater excellence of execution and workmanship that the modern fixture excels its predecessor, even more than in design. There is a perfection of finish in every detail of such designs as those here shown that alone can make them objects of art.

The old garish finish is also a thing that has passed away to a large extent, and in its place we have the far more pleasing matt and oxidized finishes that are more restful to the eye while bringing out the true perspective of form.

FIG. 8.

A Real Chandelier

FIG. 1.

The word "Chandelier" has become so common as applied to a fixture using gas or electric lamps that we have to stop and think to recall its original meaning, that of a holder of candles, and, furthermore, we have come to think of the candle as a relic of bygone days. The fact remains that there are more candles made to-day than ever before in the history of the world, and fixtures especially designed for their use are necessarily manufactured on a commercial scale. The candlestick, of course, is the most common fixture for the use of this illumination, a chandelier or fixture suspended from the ceiling being rare.

The popularity of the candle has undoubtedly been rather on the increase of late. A modern chandelier designed and manufactured for present use with real candles is shown in Fig. 1. The design is simple, as befits this primitive light source. Fig. 2 shows a side bracket of the same general character. The candle persists partly from historic associations and partly from the inherent attractiveness of a flame. The mellowness of the light and its moderate intensity, coming as a relief from the modern tendency to garishness, is also a factor in its continued use.

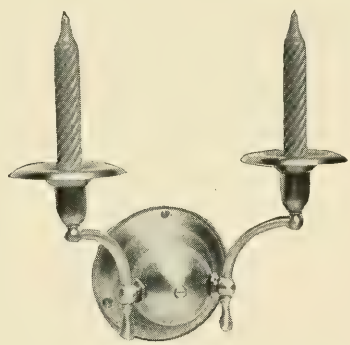


FIG. 2.

Theory and Technology

The Photometry of Colored Light Sources

(*Continued.*)

By S. G. Hibben.

Ratio Tests with the Flicker Photometer.

It has been a question with investigators of late, as to whether the flicker photometer proves equal to the claims of its inventors for it. The statement has been made that the instrument is equally as good for various colors and intensities as for clear white lights. The investigators here question these radical statements, and have attempted to show just what effects the change of intensity of illumination will cause in the comparison ratios of different colored lights. Tests were made using the same apparatus as previously, viz., a photometer bar, but with a flicker screen. The distance between the light source was varied over five points, viz., of 300, 250, 200, 150 and 100 centimeters. On all of these points a series of twenty readings were taken by each of the two observers. Voltages of the two lamps under test were maintained constant throughout the run. The data of each observer was kept separate in order to determine a value for the difference in observers, or to show the results of the "human equation."

The first set of data was made to obtain a comparison of colored light-sources with clear white lights.

1. Comparisons of white to white. (Fig. 6.)

As a preliminary basis for comparison, a test was made between two white lamps, which would be expected to give a horizontal straight line of plotted results. In fact, the curve is as near this as could be hoped, and does not show any more than a probable error. The maximum ratio is of 1:1.06, and the minimum of 1:1. One remarkable result, as seen from all of these curves, is the difference in the values obtained by two observers. In this white-to-white test the values read by observer B, all lie above those of A, and differ by about the same amount. Similar differences are pointed out for other comparisons. Without an optical investigation into the eye of these observers, no explana-

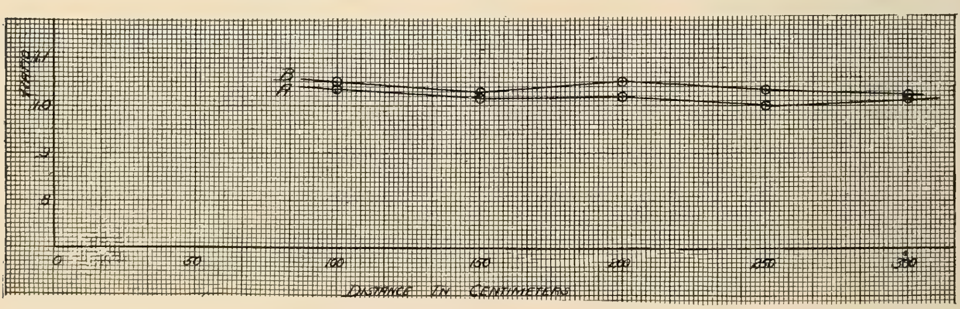


FIG. 6.—INTENSITY RATIO CURVES, WHITE TO WHITE.

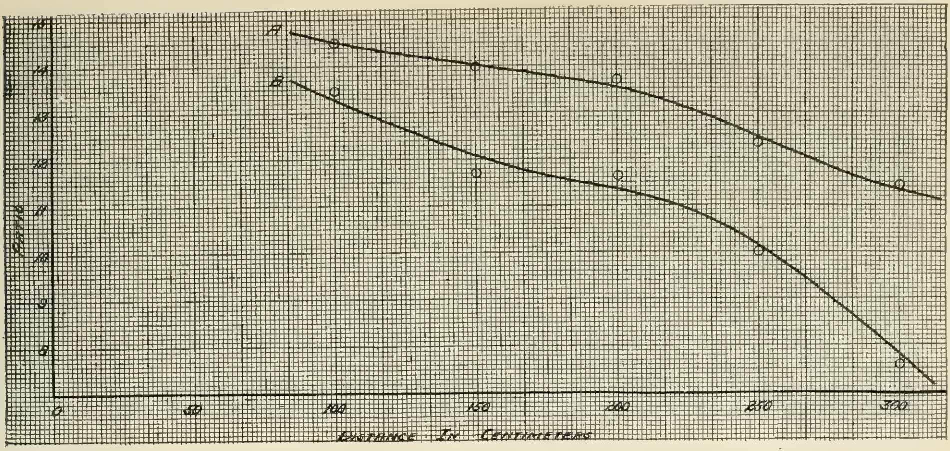


FIG. 7.—INTENSITY RATIO CURVES, WHITE TO BLUE.

tion can be made of the differences. Both men seemed to possess normal vision, and to agree on color-values, etc. "A" probably relied more upon the use of glasses than "B", and wore these when making a reading. The latter observer made no use of artificial aid to his sight during the tests.

2. Comparisons of white to blue. (Fig. 7.)

The difficulty of a sharp setting became very manifest in this test, but the large number of readings was counted on to offset such error in large part. Starting 300 cms. apart, the white incandescent lamp appears to be between 11 and 12 times as bright as the cobalt-blue one, according to observer A, and between 7 and 8 times as bright, as seen by B. (The white lamp was at 4 c.-p., and the blue lamp was rated at 16 c.-p.) As the distance decreases, the blue is reduced, and the white accentuates in value to a point where the white appears to be nearly 15 times as bright as the blue lamp. These results would seem to indicate that the relative intensity of blue sensation decreased with stronger illumination—a result in accordance with the Purkinge theory, long since determined, and which is touched upon in a following paragraph.

3. Comparisons of white to green. (Fig. 8.)

The signal-green lamp used was rated 16 c.-p. at 115 volts, and tested to be brighter than the similarly rated blue or

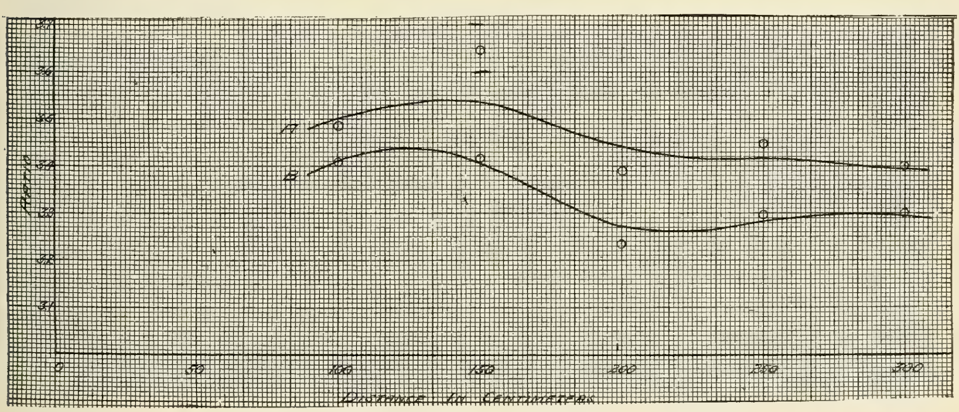


FIG. 8.—INTENSITY RATIO CURVES, WHITE TO GREEN.

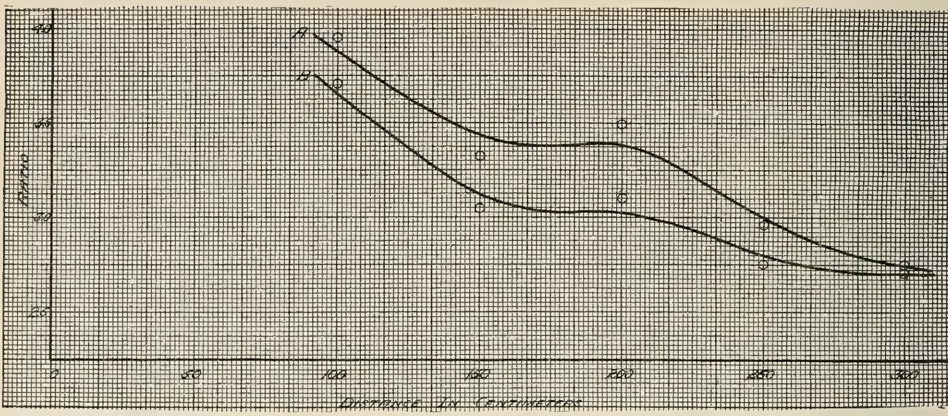


FIG. 9.—INTENSITY RATIO CURVES, GREEN TO BLUE.

red lamps. The ratios of the 4 c.-p. white to the green lamp varied from a minimum of 3.22 to 3.65—a much less variation than the white-to-blue test. The general trend of both curves points to the assumption that the green light behaves as does the blue, but in a much less marked degree, i. e., it decreases in relative value as the intensity increases. A corresponding difference is seen between the two observers, as in test No. 2, viz., the readings of A are not as favorable towards the green lights as are B's.

The second set of comparisons was between colored lights only.

4. Comparisons of green to blue. (Fig. 9.)

The rated 16 c.-p. signal-green lamp here appears to be from 2.7 to 3.9 as bright as a similarly rated cobalt-blue one. The general trend of the set of curves is in favor of the green lamp, as the strength of the illumination increases. In other words, the Purkinge effects are stronger for this shade of blue than for the green color, and with a decrease of illumination the blue grows stronger relatively faster than the green until they are practically equal at 300 cms. distance. With increase of intensity the green accentuates more rapidly than the blue. The readings of A here are universally more in favor of the green color than are B's.

5. Comparisons of green to red. (Fig. 10.)

These distance-ratio tests of green to

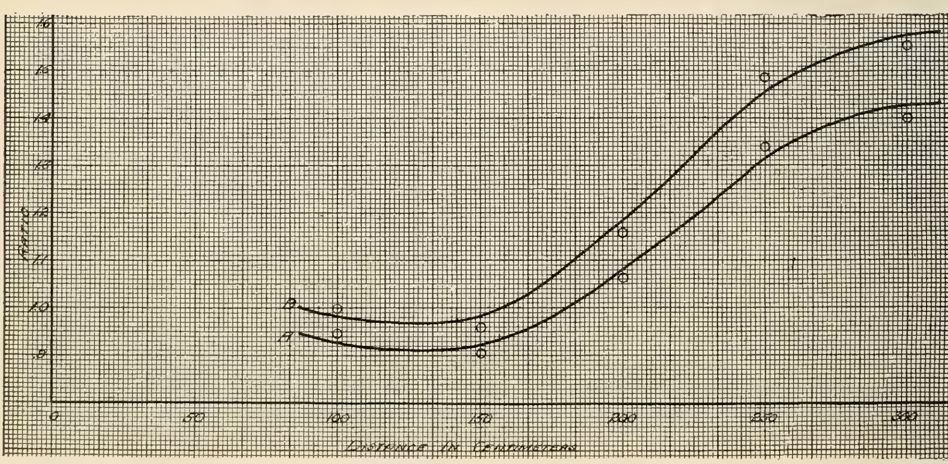


FIG. 10.—INTENSITY RATIO CURVES, GREEN TO RED.

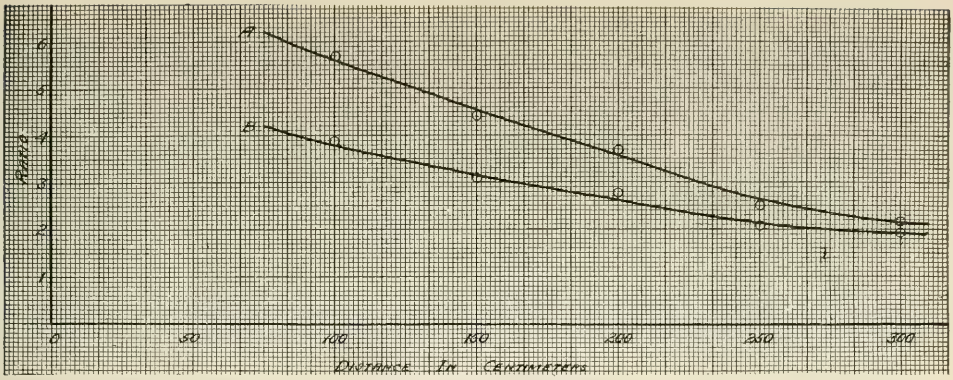


FIG. 11.—INTENSITY RATIO CURVES, RED TO BLUE.

red lamps prove still more conclusively the accentuation of the red shades with increased intensity of illumination. Let it be kept in mind that these remarks concern ratios only, and though the green lamp is nominally brighter than the red one, yet the ratio of green to red decreases with decrease of distance. The discrepancy between observers is not quite so marked here as under the previous conditions.

6. Comparisons of red to blue. (Fig. 11.)

Bearing out the findings of the previous paragraphs, the increase of illumination intensity gives rise to an increase of the red and a decrease of the blue values. Note again the differences of observers.

Some comprehensive though not altogether new conclusions can be drawn from these curves, as follows: In general, the exact comparison of widely varying colors is difficult, even with the flicker photometer. Blue-to-red comparisons are particularly hard to judge. Blue-to-green readings are much easier and probably more accurate, and red-to-white comparisons are also particularly difficult. The sight-fields show in other than their true colors, e. g., in comparing red to white, the field illuminated from the white source appears a dark-bluish to drab color, and for green to white comparisons, the white fields show orange tints. Again the results lead to the conclusions that Purkinge effects are pronounced and must be considered in such work. The flicker photometer is, moreover, affected by these causes. Finally, it can be considered that observers do not necessarily agree in their readings. Possibly in the case of the two observers there were slight signs of color-blindness of special character. Bearing out this theory are the facts that, as seen from the curves, for green and blue tints the results of A's observations in general give to these colors higher values of intensity than do B's, while the latter sees a red color as brighter than does the former observer. In all cases a large amount of practice in judging the minimum flicker is essential for color measurements, and a large number of observers and of readings are desirable.

(To be continued.)

Efficiency of the User Rather Than Efficiency of the Light

The Next Step in the Progress of Illuminating Engineering

The one paramount object sought for in illumination in the past has been to cheapen its production. Artificial light through all ages up to the present has been an expensive luxury. The use of the candle as a votive offering, which still persists as a tradition, is an eloquent witness of the preciousness of light. We are ready to marvel at the invention of the telegraph, the telephone, the flying machine and the score of other modern inventions which have added to the convenience and the pleasure of living, and to wonder how we could continue to exist if they were to be taken from us; but there is not one of these remarkable creations of modern science that we could not dispense with ten times better than the modern methods of producing artificial light. The accidental stoppage of even one of our modern illuminants occasionally gives us an object lesson of what such a calamity would mean.

Artificial light has become so cheap that it is not only within the reach of all, but is abundantly and often extravagantly used by the poorest as well as the richest; and the past five years has witnessed a still further material reduction in its cost. While there has been a general rise in the price of all commodities, including both necessities and luxuries, during the past half century, the cost of light during this same period has constantly decreased. But still the effort goes on to cheapen the production of this invaluable commodity, and the demand for economy in its use is almost as insistent as at any time since it became a common article of consumption among all classes.

There is perhaps no other practice that so fully exposes the foibles of human nature as that which passes under the general title of economy. To worry, and strain, and calculate in order to save pennies on necessities, and to expend without hesitation dollars on luxuries, is a habit that is common to all sorts and conditions of humanity. In fact, the actual meaning of economy, derived from actions rather than from the dictionaries, is to trim on necessities in order to lavish on luxuries. This idiosyncrasy may account to some extent for the disputes on lighting bills that involve comparatively insignificant amounts. Compared with the other expenses of living or of doing business, the cost of light at the present time is an insignificant factor.

The efforts to supply this universal necessity at a minimum of cost, and to use it without unnecessary waste are both commendable, and both have become common practices. But saving on cost is by no means the only element in economy. This factor has, in colloquial phrase, been worked to the limit in the sale and use of illuminants. The miser that spends a life in toil and privation to leave a hoard of gold has in the general opinion exer-

cised very poor economy. The one thing whose preciousness is above all price is the enjoyment of life. Anything which adds to this is economy, and that which needlessly subtracts from it is miserly parsimony. The right enjoyment of life is the only standard of value by which all things material as well as spiritual must finally be measured. Economy in the use of light is a virtue only to the extent that it reduces waste without in any way interfering with the comfort or pleasure of the user.

Economy of Human Energy the True Test of Efficient Lighting.

The time has come to preach the doctrine of comfort and conservation of human energy as the test of efficiency of illumination, rather than the saving of a trifling amount in the cost of the light used. Not light, but its user, is the thing to be conserved.

A saving of 50 per cent. in any expenditure is a large proportion, but what does it amount to in the expenditure of a dollar as against the discomfort that can arise from strained or overworked eyes? And yet there is many a lighting bill that does not average a dollar a month for each individual user.

The importance of securing illumination that produces the greatest possible amount of comfort to the eyes, and consequently the greatest efficiency of the individual, in both the power to do and to enjoy, is the next lesson to be taught the public. Not the abuse of light, but the abuse of the eyes, is the keynote for future reform.

With every improvement in the production of light by way of mechanical efficiency there has come a counterbalancing danger to the eyes in its use; and this the public must be made to understand. Chemistry has enabled us to extract the principles of drugs so that a single grain of substance will produce the effect of a pound of the gross material from which it was extracted; but manifestly strychnine must be taken with greater precaution than a decoction of nux vomica. Mazda or tungsten lamps are three times more efficient in light production than carbon filament lamps, and it needs to be used with at least three times the precaution; and so for any of the other modern light sources. The great value of this increase in efficiency is not that we may reduce the lighting bills to one-third, but that we may produce three times the amount of light, and therefore be able to utilize it in such a manner as to produce an illumination that is much more than three times as comfortable and agreeable to the eyes and the esthetic sense. To seek and procure a larger measure of enjoyment and comfort for the same expenditure is the highest type of economy.

Science, the Great Emancipator.

In carrying on the complicated, exacting work which constitutes modern civilization we are coming to realize more and more that above all things is Man. Science has been both the emancipator and the evangelist. The invention of the steam engine loosened more shackles than all the emancipation proclamations of history; and the discovery that the dynamo electric generator is reversible, that the mysterious force generated by one can produce motion in another, has been a greater power for moral uplift than all the theological dissertations of the centuries.

With the advancement of physical science the human machine has gradually ceased to be a prime mover and come to be a thinking machine. The value and power of the thinking individual is perhaps most strikingly shown in modern warfare. But the supremacy of the mind over matter is just as real, if not as spectacular, in the numerous pursuits of peace. In every manufacturing and producing enterprise the most valuable of all machines is the human machine, for upon it depends absolutely the operation and output of all other devices. To conserve this master-machine is therefore but an act of common and obvious prudence.

Modern civilization is rapidly advancing toward the universal brotherhood of man, not because it is right in the eyes of any higher power, imaginary or real, but because it best conserves the purposes of society. It is "good business" in every sense of the word for the manufacturer to take the best of care of his operatives. We need not be surprised, therefore, to learn that the most systematic and effec-

tive efforts toward conserving the human machine are being made by the most successful and powerful business organizations. The recent efforts in this direction by the National Electric Light Association may be cited as an instance.

General Neglect of the Importance of Conserving Vision.

The part which vision plays in the human economy has been comparatively neglected. The necessity of sanitation and hygiene affecting all the other functions of the body is fairly well recognized; but the hygiene of the eyes is still in a state of uncertainty and neglect. Occasionally an oculist or physician has raised his voice in warning of exhortation, but it has been the case of " a voice crying in the wilderness," and even some times of being shouted down by the opposition of ignorance or prejudice. Most vigorous of these voices so far heard is that of Dr. George M. Gould, whose knowledge none dares to dispute, but whose vigor of protest has frightened the conservative and engendered more or less open opposition. In Volume I of his " Biographic Clinics," in the chapter on " Physiology of Vision," Dr. Gould thus vigorously denounces the prevailing practices of artificial lighting:

> Another corollary of the law of ocular tire and resensitization may be noticed in passing —a law that is outraged by the lighting of most of our churches and of all of our private houses, theaters, public halls, etc. The millions of dollars spent each year in illumination are in great part wasted and misspent, and by the methods used all the harm is done to the eye that is possible. No room should be lit in such a manner that the individual lights are visible. Illumination should be by transmitted, dissipated and reflected light. There is nothing more tiring to the eye than numerous separate lights, whose images upon various parts of the retina create there a large number of useless and exhausting stimuli, and from which there is no escape by any device or turning. American oculists have so many patients who, even with the best spectacles, cannot escape suffering whenever they go to the theater, opera, etc., that the term " theater-headache," or " panorama headache," has come into general use. As much as to the character of the sermon or of the worshiper, the famous sleepiness of the churchgoer was due to the somnolence caused by ocular fatigue from harsh lights in front. One of the most common symptoms of eye-strain known of all oculists is sleepiness when reading by artificial light. Part of this is certainly due to unphysiologic systems and qualities of the light used.

Saving Light at the Expense of the Eyes Poor Economy.

Which is the wiser economy, to avoid smarting, burning eyes, headache, torpid mental powers, and a long train of possible physical ills, at the cost of a few additional units of electric current or cubic feet of gas, or to " cut down the lighting bills " and let the eyes and body take care of themselves?

When the improved electric lamps came into the market in rapid succession a few years ago, they spread consternation among the central station interests by reason of the prospective reduction in electric current which their greatly increased efficiency foreshadowed. The first cry of relief was, " Raise the standard of illumination "; in other words, prevail upon the people to use a higher intensity of illumination. In order that this might be carried out with the least effort at public education the old familiar candle power rating of the new lamps was omitted and the meaningless watt rating substituted. Thus it was hoped that the people would use two or three times as much light and consequently about the same amount of current. To a greater or less extent, this has undoubtedly been accomplished, and perhaps not entirely to the consumer's disadvantage. But the principle is wrong. We do not necessarily need *greater intensity* of illumination, but we do most seriously need a *better quality* of illumination.

Commercial and Humanitarian Motives Not Inconsistent.

Let the central stations now take up actively the promotion of this serious and actual need. Every unshaded or unfrosted electric lamp should be considered a danger signal, and those responsible for its existence should be marked as persons to be educated to a higher appreciation of the value of vision and the means of conserving the visual organs. " No bare lights " is a slogan that expresses the consensus of the best authorities on artificial illumination to-day, and it may well take the place of the former cry of

"Raise the standard of illumination."

By preaching the gospel of caring for the comfort and efficiency of the individual through providing illumination that is most effective and hygienic to the eyes, the central stations will promote their own financial interests, and at the same time accomplish a humanitarian work that will be of immeasurable value. This union of profit and philanthropy is by no means an unusual coincidence. On the contrary, all right commercialism is directly humanitarian; and with equal truth it can be said that all true humanitarian movements are necessarily of commercial advantage. Money is not an evil, nor even the love of it, unless perverted, and between all good there is a universal and mutual affinity.

BETTER *light rather than* MORE *light is the next step.*

Following this principle, which is as real as the law of gravitation, every branch of the lighting industry will be commercially benefited by this advance step in the use of light; and the benefits will be proportional to the sincerity and vigor which is shown in developing and promoting this reform. The hygienic use of light necessarily carries with it generation of a greater quantity of light, and this means more light-sources and more illuminants. Here, again, a universal law governing price comes in: the larger the production the less the cost of manufacture, and ultimately the less the selling cost; so that in the end both producer and consumer are benefited.

To the manufacturer of lighting accessories this care for ocular hygiene so greatly widens his field of usefulness as to almost create a new territory. The old devices that were either simply manipulators of light for light's sake, or fancifully decorative for mere fancy's sake, must both disappear and their place be taken by devices which will primarily fulfill the demands of hygienic vision, and, secondarily, conform to the best ideals of art. The new forms of diffusing glass that have been developed to such remarkable perfection within the past two years are long strides in this direction; but as yet little more has been done than to produce a superior form of material. The possibilities both on the practical and artistic sides are unlimited and as yet but little worked.

The manufacturer of lighting fixtures, if he will but recognize it, has an unprecedented opportunity for extending and improving his business. There is little profit, and still less glory, in ringing over the changes on the same old motives that have been harped upon for the last three centuries. Lighting is not an accident, but a prime necessity in a modern building, and the methods of best utilizing the splendid light-sources now at the command of the designer is a work that ranks second to none in the plan and construction of even the most monumental buildings.

Color of Light and Visual Acuity

By visual acuity is commonly understood the ability of the eye to distinguish fine detail. While this understanding of the term is true, it does not quite express the whole truth; visual acuity also includes distinctness of any object having a sharply defined outline. Thus, the boundary line between white paper and black print, no matter how coarse, may appear sharp, or the white may run into the black to a greater or less extent, giving a soft or blurred edge.

Acuity is the first and most important quality of vision. When the eye fails to register a sharp impression of the object looked at something is wrong, either in the organs of vision or the conditions under which they are used. Blurred or indistinct visual impressions are therefore a notice to visit the oculist for glasses, or to investigate the conditions of illumination under which the eye is working. The color sense is purely ornamental. Some few individuals are wholly destitute of this sense and suffer no practical inconvenience therefrom.

Acuity of vision depends upon three things: the condition of the eye, the surface brightness of the object looked upon, and the color of the light by which it is illuminated. Assuming the eye to be either normal—*i. e.,* as nearly optically perfect as its structure permits—or its optical imperfections properly corrected with glasses, the two determining conditions of distinct vision are the intensity and color of the illumination by which objects are viewed.

Illuminating engineers have thus far regarded only one of these conditions, and have measured the value of illumination solely by its intensity.

The nearly monochromatic light of the mercury vapor lamp, which, as a commercial light-source, has been steadily increasing in use, is largely responsible for the greater interest which has recently been taken in the subject of visual acuity as affected by color of light. It has been a matter of common observation that the peculiar blue-green color of this light gives an unusual distinctness to all fine or sharp outlines viewed by it. While the fact was so apparent as to not only be readily observed, but to attract the attention of the ordinary observer, the scientific explanation has been more or less a matter of conjecture.

A series of experiments to determine the cause of this apparent increase in visual acuity has been carried out to a positive conclusion by Dr. Louis Bell and Dr. Charles H. Williams, the results of which were contributed to the *Electrical World* of May 11. The practical conclusion arrived at is that approximately monochromatic light of the middle portion of the spectrum, *i. e.,* yellow or green, is nearly twice as efficient in producing distinct vision as white light, *i. e.,* light containing all of the visible rays. In other words, it requires twice the surface brightness on an object, such, for example, as an ordinary printed page, to make it distinctly visible by white light as by yellow or green light, the intensities being taken within the range where vision is most effective. With lower intensities, which constitute what would be called "dim" light, green has the advantage over yellow.

The explanation is a simple one: The eye at the best is by no means a perfect optical instrument; it is subject to very considerable "chromatic aberration." This is the scientific expression signifying that the different colors of light are not brought to the same focus by the optical parts of the eye. If you look through a common magnifying glass you will see the sharp outlines of objects fringed with colors. This is due to the fact that each different color is brought to a different focus by the lens, and if you focus sharply for one color the other colors will be out of focus; and as white, or ordinary, light contains all of the colors, some of these must necessarily be out of focus. This is precisely what happens in the eye in the case of light containing all the colors. The eye instinctively strikes an average, and focuses for the color that produces the strongest visual effect, which is greenish-yellow, so that the blue, violet and red fringe the outlines of the retinal image. These color fringes on the retina are not sufficiently vivid to produce the color sensation, but merely soften or blur the outlines. Now, if there is only one color, such as yellow or green, the eye focuses for this and does it perfectly, hence the image on the retina is sharp and vision distinct.

This increase in visual acuity from monochromatic light presents several important and rather curious problems. The nearly perfect efficiency of the light of the firefly has been a theme for popular scientific writers for many years, and the insect has been pointed to as the prototype of the "light of the future." Its light is practically monochromatic, and of the most advantageous color, *i. e.,* greenish-yellow. If acuity of vision is to be the measure of illuminating efficiency—and it unquestionably is for many purposes—those seeking to improve efficiency of light production will work toward securing monochromatic light.

If the eye can see more distinctly, so far as outline and form are concerned, by monochromatic light, then why should not all light be made approximately monochromatic for vision in which color is not essential. By cutting out the light at both ends of the spectrum visual acuity would be improved and the total amount of energy transmitted to the optic nerve would be reduced. The blue end of the spectrum, especially the invisible rays just beyond the visible part, has been charged with being not only useless, but positively injurious, and the indictment has been proven true, at least where the rays are of considerable intensity; ultra-violet light is capable of inflicting the most serious injury where it is sufficiently intense. It is fairly logical to conclude from this that less intensities would be deleterious. Light at the red end of the spectrum, on account of its greater amount of energy, is likewise

considered by Dr. Steinmetz and others as harmful, on account of the fatigue which it produces from its excessive energy. By cutting out all of this light which is under strong suspicion of being injurious, and retaining only the portion of the spectrum which produces the strongest and clearest visual effect, would we not secure an illumination under which the eye could work with far greater ease and freedom from strain and fatigue? A combination of green and yellow screens could readily be devised which would almost, if not quite, quench the light from the ends of the spectrum; and, although this would reduce the intensity of surface brightness on an object somewhat, it would doubtless increase the acuity of vision. What is the use of subjecting the extremely delicate organism of the eye to two or three times the amount of stimulus necessary to produce the required visual sensation?

Worshipers of the evolution theory will undoubtedly immediately object that the eye has been developed under composite light, and that therefore any other kind must be harmful; but this is a mere hypothesis which is absolutely lacking in confirmation at the present time. The digestive organs have also evolved a vermiform appendix, but we have found that it can be dispensed with safely, if not with positive advantage.

Another fact suggested by Dr. Bell's experiments is the inaccuracy of photometric methods in registering the practical value of illumination. Surface brightness, which is the thing that photometry is concerned with, is only one of the elements of the visual sense, and the discrepancy between this measurement and the ability of the eye to see may reach 100 per cent. Working for an accuracy of 1 per cent. in a photometric measurement and then introducing a discrepancy of 100 per cent. is something of an anomaly, is it not? Illuminating engineers have created the expression "effective lumens." Is it not even more important to have some measure of effective illumination?

The relation of visual acuity to intensity of illumination, or surface brightness, and to the strain or fatigue of the eye, is a subject which needs to be very thoroughly exploited.

Uniform Illumination

In the discussions of indirect illumination the point has frequently been raised that there is too great uniformity. The theory is well stated by Mr. Critenden in his recent article in the "Scientific American."

"Two serious objections arise from that very uniformity which has been mentioned as being the great virtue of indirect lighting. It may be *too* uniform. The eyes, tired from the bright light on the page or the drawing before them, involuntarily seek relief by turning to some less brilliant object. Now, if on all sides they meet white walls and uniform brightness no rest is obtained and fatigue comes quickly."

The argument thus set forth persists on account of its superficial plausibility. Even the most casual comparison of the results of indirect lighting with general conditions of daylight illumination will show that the argument is only a plausible fallacy. If the side walls of a room were white or the same tint as the ceiling; if there were no pictures, curtained windows, or other objects to break their monotony; if the floors and furnishings were also white, then the argument would hold. But these are conditions which never exist; side walls are practically always colored and relieved by various objects, more or less dark in tint, and the same with furnishings. The eye never instinctively turns up for rest, but always down.

The sky, leaving out the sun itself, which of course is never directly looked at, is of generally uniform intensity; and even when clouds and blue sky alternate, there is as near uniformity as in the case of a ceiling lighted for indirect illumination. Moreover, the best results of indirect illumination do not equal diffused daylight, which is the only kind of natural illumination suitable for close eye work, in respect to uniformity. As every one knows, nothing is so restful to the eyes as the open country. While there is an abundance of light, and a comparatively uniform intensity overhead, there is variety of light, shade, and color in the direction in which the eye naturally rests.

The fallacy of the argument arises from a too close adherence to mere physical facts. Illuminating engineers have talked so much about foot-candles of in-

tensity, and "illumination on the working plane," that they have lost sight of the fact that, so far as the eye is concerned, these terms have practically no significance; the thing that counts is not intensity measured in this way, but the surface brightness of the objects upon which the eye habitually or most frequently rests. On a dead black surface it makes little difference what the intensity of illumination, measured by an illuminometer, would show; the surface would still be pretty nearly black. Floor coverings, and at least the lower portion of side walls, should be of comparatively dark colors, greens being undoubtedly favorable as most closely imitating nature; and all tables and desks upon which writing, reading, or any other close eye work is performed, should preferably be of a dead black finish—at all events there should be no polish, and the darker the color the better.

Another criticism of indirect lighting that has been going the rounds without serious contradiction is its alleged shadowless quality. Here again the actual facts are against the argument, providing the indirect lighting has been judiciously laid out. This argument perhaps originated in some of the early attempts at indirect lighting, which utilized the so-called "cove" method, the light thus emanating equally from the upper four corners of the room. This would produce equal cross lights, and therefore as complete freedom from shadows as it is possible to obtain. Cove lighting, however, is by no means synonymous with indirect lighting; on the contrary, it has been generally discarded by both parties to the controversy. Indirect lighting from units placed more or less centrally in the ceiling produces modified shadows to a greater or less extent, according to the position in the room, very much in the same manner that daylight from a number of windows produces shadows. The most objectionable shadows are those produced by direct illumination using a large number of units; even entire absence of shadows is preferable to multiple shadows.

On this subject the remarks of Dr. George M. Gould, M.D., one of the highest authorities on ophthalmology in this country, in an article on "The Eyes and Their Light" in the *Dietetic and Hygienic Gazette*, may assist the reader in drawing his conclusions:

"The usual artificial illumination of our houses and public meeting rooms is, as well known, utterly wrong and unnatural. In the open, the source of light, the sun, is usually, and when brightest, above our heads; indoors it is usually on a level with the eyes. In nature it is a single source; in the house it is multiple. Out-of-doors we have learned well enough not to look at the sun, but in the house we are usually compelled to look at the naked flame, the white-hot filament, etc. We should imitate Nature in making the lighting of our rooms from a single high source, the light from which is reflected and diffused."

Artificial Daylight

The production by artificial means of light which shall have the visual effect of the natural product is a problem which possesses both scientific and practical interest. There is always a certain satisfaction in being able to reproduce the works of nature, and this satisfaction is greatly enhanced by the knowledge that successful efforts of this kind usually have practical value.

The first step in the reproduction of a natural product is analysis, by which the constitutent elements of the product are made known. In the case of natural light this has been very completely done; we know to the utmost exactness the composition of daylight. There are then three possible means of reproducing it artificially.

First, by the synthesis of the different elements produced separately; second, by the modification of light produced by ordinary means; and third, by the actual production of light possessing all the required elements.

The first of these methods has been proposed by Steinmetz as a means of securing white light, incandescent vapors of different kinds being used for producing the various colors. The modification of ordinary yellow light produced from incandescent solids has been worked out by Ives and Luckiesh by the use of different colored glasses which extinguish a sufficient amount of yellow and red rays to leave the proportion necessary for producing visual white light. The third

method has been successfully employed by Moore in his carbon dioxide tube. This interesting problem has therefore been solved by all three possible methods.

The most practical for commercial use is that of Moore, his white light tube being now quite extensively used where artificial white light is necessary.

The method of Ives and Luckiesh is valuable practically on account of its great simplicity, which makes it available where the more expensive Moore tube might be impracticable.

Steinmetz' method has little promise of practical application.

The N. E. L. A. Convention

Life in civilized society, to paraphrase an aphorism that is usually more forceful than elegant, is " just one convention after another." How large a part of our actions are performed because of convention —the general agreement of others to act thus and so! We tell a thousand lies without so much as winking in our conscience, knowing full well that those to whom they are told do not for a moment suspect the statements of being true. We say to the stranger that is presented to us that we are " delighted to make his acquaintance," when in fact we may have no more joy in the action than we would experience in reading the multiplication table. But fortunately there are exceptions in this eternal round of conventionalities. There are occasions when we are really glad to have met a stranger, and when we sincerely hope that we shall meet him again.

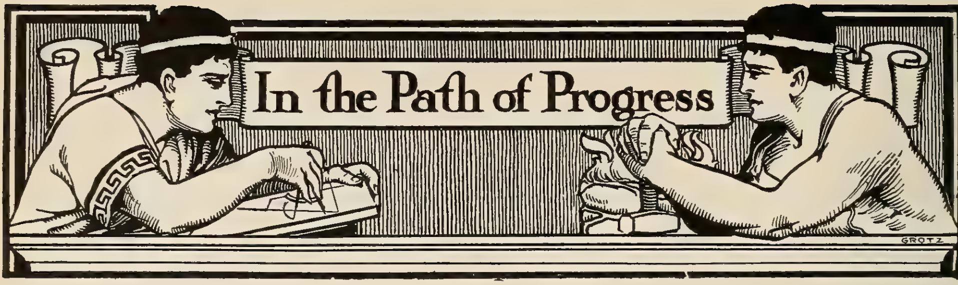
It is one of the conventions of technical journalism to speak well of all gatherings in which the journal has a practical interest. The N. E. L. A. convention affords one of the happy instances where the conventional compliments can be extended without in the least violating the strictest principles of veracity. The convention is a good thing from whatever angle it is viewed; and it is always a delight to the normal mind to be able to speak the truth and praise at the same time. Here is a gathering of men from every quarter of our country, each of whom is engaged, both in the physical and moral sense, in the great work of disseminating light. An enormous aggregation of capital and income is represented, and yet there are no unholy alliances to secure undue profits, nor to restrain trade or create monopoly. On the contrary, there is perhaps no other great business, with the exception of transportation, that so tends to the expansion of trade as this of producing light and power; for what two elements are more vital in industry, commerce and social existence than light and power? The latter of these created the universe and the former endowed it with life.

The Editor, THE ILLUMINATING ENGINEER.

DEAR SIR.—I desire to call your especial attention to the facilities offered by the Library of the Engineering Societies, at 29 West Thirty-ninth street, New York City. The library is formed from the combined libraries of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers, and contains over forty thousand volumes on engineering subjects. It is open for reference to the general public, without charge, every day and evening, except Sundays. The library is supplied with all the published indexes, has most complete sets of periodicals both domestic and foreign, and has a well trained reference staff.

Students residing in New York City and vicinity are especially invited to utilize the library in their researches on technological subjects. The library is on the top floor of the United Engineering Society Building, is quiet, well lighted and ventilated. Those who are prevented from visiting the library by distance or business engagements may nevertheless receive assistance. The library is prepared to furnish references on engineering subjects to persons at a distance, and also to furnish transcripts, translations and photographic reproductions of diagrams and maps. For such work, if extensive, a moderate charge is made. Correspondence is welcomed; telegraphic and telephonic inquiries will receive especial attention.

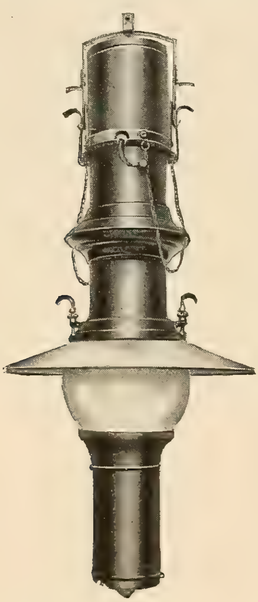
Very truly yours,
W. P. CUTTER,
Librarian.



A Long Burning Flaming Arc Lamp

A long burning flaming arc lamp, which does actually burn for a long time on one trim—125 hours, is certainly a long life for any pair of carbons—is announced by the Excello Arc Lamp Company.

The fact that the lamp is brought out by this company and under the special designation of the H. M. H. (H. M. Hirschberg), president of the company, is a strong guarantee that it will perform according to representations. It would be the most ill-advised policy for a company of this reputation to act otherwise. The lamp is of the vertical carbon inclosed type, the inclosure is accomplished by two globes, the inner of heat resisting glass 7 in. long and 5¾ in. in diameter, of plain cylindrical form; the outer globe is a sphere 9¾ in. in diameter, and can be made of any kind of diffusing glass required. Openings of both globes are carefully closed, except by the special ventilating device. A form of carbon worked out by one of the world's most famous makers, C. Conradty, is used, which is responsible for the exceedingly long life.



THE NEW H. M. H. EXCELLO FLAME ARC LAMP.

The lamps are absolutely guaranteed to keep in perfect working order for two years, and are made for both alternating and direct current. This lamp has been undergoing practical trial for more than a year, and is now put out by the Excello Arc Lamp Company, New York, with full confidence in its ability to meet all reasonable requirements of a long burning flaming arc lamp.

Canadian Holophane Company Organized

The Holophane Company, Limited, of Canada, has been organized, and will be ready to do business June 1.

The Canadian company will be under direct charge of Mr. C. A. Howe as general manager, who has heretofore had charge of the Chicago office of the Holophane Company. He will be assisted by Mr. H. D. Howe, who will hold the position of secretary in the Canadian company.

Holophane, Limited, will have its offices and stock rooms at 60-62 Front street, West, Toronto, where a large and complete stock of Holophane glass and Holophane-D'Olier steel reflectors will be kept in stock for immediate shipment.

The Carrara Reflector

Under this name the Gleason-Tiebout Glass Company, Brooklyn, N. Y., have introduced a reflector of a glass which has a striking resemblance to the famous marble from which they have given it its name. While possessing sufficient reflecting power to entitle it justly to the name of reflector, this glass transmits in a perfectly diffused form a sufficient amount of light to give the requisite illumination on side walls and ceiling.

The glass has a particularly effective appearance by daylight, being entirely free from the glassy look of the familiar opal. The line embraces a number of artistic shapes suitable for tungsten and Mazda lamps.

The Melilite Reflector

The advantage of considering softness of diffusion and the mellowness of illumination rather than the last limit of rereflection is exemplified in the new reflector just put out under the above named by Gillinder & Sons, Inc., Philadelphia.

GILLINDER MELILITE REFLECTOR.

The material is a glass of a pearly translucence and lustre, which has a remarkable power of diffusion combined with apparent translucency. The reflective power is also sufficient for practical purposes. The design of this line of reflectors is noteworthy in being a departure from the so-called "Sheffield" pattern, which has now become so common.

Personal

Mr. F. Laurent Godinez has severed his connection with the Central Station Development Company, Cleveland, Ohio, and will henceforth give his entire attention to consulting engineering as a specialist in illumination.

Mr. Godinez's intimate knowledge of central station engineering and commercial practice, together with his fund of originality in designing unusual illuminating effects, should make his services particularly valuable to manufacturers of lighting appliances and to central stations.

Agens & Hopper is the title of a new corporation formed under the laws of New Jersey to conduct a general business of jobbing in lighting, power, and signal supplies. The president is Mr. S. H. M. Agens, formerly connected with the Electric Motor & Equipment Co., which the new firm succeeds. The business will be conducted at 219 Market Street, Newark, N. J.

The many patrons of Mr. Agens in his former capacity will surely be pleased to learn that they can continue to do business with a corporation under his general management.

Cornelius H. Tiebout

Mr. Tiebout died on the 24th inst., following an operation in the Pilcher Hospital for a serious ailment. He was seventy-seven years of age. Mr. Tiebout has been active in business life, and one of the best known residents of the Greenpoint section of Brooklyn for many years. He was connected with the Williamsburg Savings Bank, and was one of the organizers of the New York Sugar Refining Co., and the North Side Bank. He was also actively interested in church and Sunday school work, and was a man of high ideals and strict integrity.

In 1902 he became interested in the Gleason-Tiebout Glass Co., becoming its treasurer. His son-in-law, Mr. Marshall W. Gleason, was the president, and his son, Mr. C. H. Tiebout, Jr., its secretary. The company has had a very prosperous career, and occupies a prominent position among makers of illuminating glassware. The spirit of courtesy and business integrity characteristic of the elder Mr. Tiebout was manifest to all who had dealings with the company.

Proceedings of Technical Societies

Program of the Thirty-Fourth Convention of the National Electric Light Association, New York, May 29, 30, 31, June 1 and 2

CALENDAR

WEEK MAY 29—JUNE 2, 1911

May 29, Monday.

1	Day	Registration Office opens 11 o'clock.
2	Evening	Reception, with Promenade Concert and Dance, 8.30 o'clock.

May 30, Tuesday Morning, 10 o'clock.
3 General Session, First.
Tuesday Afternoon, 2.30 o'clock.
4 General Session, Second.
5 Technical Session, First.
6 Accounting Session, First.

May 31, Wednesday Morning, 10 o'clock.
7 Commercial Session, First.
8 Executive Session, 12.30 o'clock (in Commercial Section Room).
9 Accounting Session, Second.
10 Technical Session, Second.
No Afternoon Session.
Wednesday Evening, 8.30 o'clock.
11 Public Policy Meeting—New Theatre.

June 1, Thursday Morning, 10.00 o'clock.
12 Power Transmission Session, First.
13 Commercial Session, Second.
14 Accounting Session, Third.
Thursday Afternoon, 2.30 o'clock.
15 Technical Session, Third.
16 Commercial Session, Third.

June 2, Friday Morning, 10.00 o'clock.
17 Power Transmission Session, Second.
18 Commercial Session, Fourth.
Friday Afternoon, 2.30 o'clock.
19 General Session, Third.

PROGRAMME

GENERAL, EXECUTIVE, PUBLIC POLICY, TECHNICAL, ACCOUNTING

AND

POWER TRANSMISSION SESSIONS

TUESDAY, 10.00 A.M.

ROOM NO. 1, MAIN AUDITORIUM

First General Session:

President Freeman, Chairman.

1. Welcome to City.
2. President's Address.
3. Announcements.
4. Report of Committee on Membership.
   H. H. Scott, New York,
   Doherty Operating Company.
5. Report of Secretary.
   T. C. Martin, New York.
6. Report of Insurance Expert.
   W. H. Blood, Jr., Boston,
   Stone & Webster Corporation.
7. Preliminary Report of Committee on Overhead Line Construction.
   Farley Osgood, Newark, N. J.,
   Public Service Electric Company.
   (To be referred for fuller presentation and discussion to Technical Session.)
8. Preliminary Report of Committee on Uniform Accounting.
   John L. Bailey, Baltimore,
   Consolidated Gas. Elec. Light and Power Co.
   (To be referred for fuller presentation and discussion to Accounting Session.)
9. Report of Committee on Progress.
   T. C. Martin, New York,
   Secretary, N. E. L. A.
10. Paper: Master and Men.
    Paul Lupke, Trenton, N. J.,
    Public Service Electric Co.
11. Presentation of Oil Portrait of Miss Harriet Billings, Assistant Secretary and Treasurer, Given by Past President Henry L. Doherty to the Association.
    W. C. L. Eglin, Philadelphia, Pa.
    Philadelphia Electric Co.

TUESDAY, 2.30 P.M.

ROOM NO. 1, MAIN AUDITORIUM

Second General Session:

President Freeman, Chairman.

1. Report on Bulletin Question Box.
   M. S. Seelman, Jr., Editor, Brooklyn,
   Brooklyn, N. Y., Edison Co.
2. Report on Question Box Revision.
   Paul Lupke, Trenton, N. J.
   Public Service Electric Co.
   Alex. J. Campbell, New London, Ct.
   New London Gas and Electric Co.

3. Report of Library Committee.
   Arthur Williams, New York.
   New York Edison Co.
4. Report of Handbook Committee.
   Arthur Williams, Chairman.
5. Report of Doherty Gold Medal Committee and Award of Medal.
   W. C. L. Eglin, Philadelphia,
   Philadelphia Electric Co.
6. Paper: Company and Company Section Bulletins.
   E. A. Edkins, Chicago, Ill.,
   Commonwealth Edison Co.
7. Topical Discussion on the Work of the Company Sections.

TUESDAY, 2.30 P.M.

ROOM NO. 2, FIFTH FLOOR

First Technical Session:

F. M. Tait, Chairman,
W. C. L. Eglin, Vice-Chairman.

1. Report of Meter Committee.
   G. A. Sawin, Newark, N. J.,
   Public Service Electric Co.
2. Report of Committee on Grounding Secondaries.
   W. H. Blood, Jr., Boston, Mass.,
   Stone & Webster Corporation.
3. Paper: Grounding of Low Tension Circuits as a Protective Measure.
   P. M. Lincoln, East Pittsburg, Pa.,
   Westinghouse Electric and Mfg. Co.
4. Paper: Recent Important Improvements in Single-phase Motors.
   W. A. Layman, St. Louis, Mo.
   Wagner Electric Mfg. Co.
5. Paper: Relation of Motor Load to Station Equipment.
   F. D. Newbury, East Pittsburg, Pa.
   Westinghouse Electric and Mfg. Co.

TUESDAY, 2.30 P.M.

ROOM NO. 3, FIFTH FLOOR

First Accounting Session:

John F. Gilchrist, Chairman.
John L. Bailey, Vice-Chairman.

1. Report of Committee on Uniform Accounting.
   John L. Bailey, Baltimore, Md.,
   Consolidated Gas, Elec. Light and Power Co.
2. Paper: Handling Customers' Orders.
   R. F. Bonsall, Baltimore, Md.,
   Consolidated Gas, Elec. Light and Power Co.
   (A method by which a customer's order may be taken by a solicitor either in the office or in his district—on the street. How to avoid duplication of work by the use of carbon copies or otherwise.)
3. Paper: The Collection of Bills.
   E. J. Bowers, Kansas City, Mo.,
   Kansas City Electric Light Co.
   (Does a rate with a discount for prompt payment of bills decrease the cost of collection? Is any cash discount greater than the two per cent. allowed by commercial practice warrantable, in view of the fact that any greater rate of discount than this amount—if not less—must necessarily take into consideration the actual cost of the product,—whereas the cash discount must be limited to consideration of the interest and collection features only? Which is the better way of notifying a customer of his delinquency—through the mails or to send a collector and then a mail notice?)
4. Paper: Electric Vehicle Accounts as Applied to a Department of a Central Station Plant.
   Hermann Spoehrer, St. Louis, Mo.,
   Union Electric Light and Power Co.
   (What is the possible extent to which the electric vehicle department of a central station shall keep accounts of income and expenses; the income representing the amount sold, income from storage, washing, oiling and cleaning and repair department; the building expenses covering lighting, heating, attendance, etc., and the expense of the repair shop, as well as the expenses for fixed charges on the vehicles owned by the company. Also to what extent has it been possible to compare accounts or expense data of electric with gasoline machines?)

WEDNESDAY, 10.00 A.M.

ROOM NO. 3, FIFTH FLOOR

Second Accounting Session:

F. M. Tait, Chairman.
John L. Bailey, Vice-Chairman.

1. Paper: Tracing Store Room Material.
   John T. Brady, Denver, Colo.,
   Denver Gas and Electric Co.
   (To cover the method of accounting for material used from the storeroom to its final disposition and the manner of making charges therefor, including provision for adequately charging consumers for such material or part thereof.)
2. Paper: The Purchasing Department.
   T. W. Buxton, Brooklyn, N. Y.,
   Brooklyn Edison Co.
   (General Practice; the relation of the auditing department to the purchasing department; accounting methods.)
3. Paper: Advantages of a Job Cost System.
   Alec Hole, New York,
   New York Edison Co.
   (To cover the extent to which a company is warranted in accounting for the cost of each piece of work. At what point does the expense exceed the advantages? The reasons?)

WEDNESDAY, 10.00 A.M.

ROOM NO. 2, FIFTH FLOOR

Second Technical Session:

President Freeman, Chairman.
W. C. L. Eglin, Vice-Chairman.

1. Report: Overhead Line Construction Committee.
   Farley Osgood, Newark, N. J.,
   Public Service Electric Co.
2. Report of Committee on Preservative Treatment of Poles and Cross Arms.
   W. K. Vanderpoel, Newark, N. J.,
   Public Service Electric Co.
3. Report of Underground Construction Committee.
   W. L. Abbott, Chicago,
   Commonwealth Edison Co.
4. Paper: Load Reports of an Electric System.
   A. S. Loizeaux, Baltimore,
   Consolidated Gas, Elec. Light and Power Co.

WEDNESDAY, 10.00 A.M.

ROOM NO. 1, MAIN AUDITORIUM

First Commercial Session:

John F. Gilchrist, Chairman.
George Williams, Vice-Chairman.

1. Address of Chairman of Commercial Section.
   George Williams, New York,
   Henry L. Doherty & Co.
2. Report of Committee on Power.
   E. W. Lloyd, Chicago, Ill.,
   Commonwealth Edison Co.
3. Report of Committee on Electricity in Rural Districts.
   J. G. Learned, Chicago, Ill.,
   North Shore Electric Co.
4. Report of Committee on Ornamental Street Lighting.
   W. R. Collier, Atlanta, Ga.,
   Georgia Railway and Light Co.

WEDNESDAY, 12.30 NOON

ROOM NO. 1, MAIN AUDITORIUM

Executive Session:

President Freeman, Chairman.

1. Action on Report of Public Policy Committee.
   Arthur Williams, New York,
   New York Edison Co.
2. Presentation of Proposed Constitutional Amendments.
   Frank W. Frueauff, Denver, Colo.,
   Denver Gas and Electric Co.
3. Report of Treasurer.
   George H. Harries, Washington, D. C.,
   Potomac Electric Power Co.
4. Election of Nominating Committee.

WEDNESDAY, 8.30 P.M.

NEW THEATRE

Public Policy Session:

President Freeman, Chairman.

1. Musical Programme will begin at 7.45 p.m., under Director Elliott Schenck, Musical Director of the New Theatre (see separate programme at theatre).
2. Presentation of Report of the Public Policy Committee.
   Past President Samuel Insull,
   Commonwealth Edison Co., Chicago.
3. Address:
   Hon. Charles Nagel,
   Secretary U. S. Department of Commerce and Labor.

THURSDAY, 10.00 A.M.

ROOM NO 2, FIFTH FLOOR

First Power Transmission Session:

John F. Gilchrist, Chairman.
J. R. McKee, Vice-Chairman.

1. Presentation of Report on the April Conference: Water Powers and Their Governmental Control.
   Dr. A. S. McAllister, Reporter,
   "Electrical World," New York.
2. Paper: Central Station Power Plants for Operating Steam Railroads Electrically.
   Fred. Darlington, East Pittsburg,
   Westinghouse Electric and Mfg. Co.
3. Report of Committee on Protection from Lightning.
   B. E. Morrow, Albany, N. Y.,
   Hudson River Electric Power Co.

THURSDAY, 10.00 A.M.

ROOM NO. 1, MAIN AUDITORIUM

Second Commercial Session:

F. M. Tait, Chairman.
George Williams, Vice-Chairman.

1. Report of Committee on Electric Vehicles.
   J. T. Hutchings, Rochester, N. Y.,
   Rochester Railway and Light Co.
2. Executive Session.
   (After the discussion and the consideration of other matters arising, the morning will be devoted to an Executive Session of the members of the National Commercial Section, when a number of important matters as to the work of the Section will be taken up.)

THURSDAY, 10.00 A.M.

ROOM NO. 3, FIFTH FLOOR

Third Accounting Session:

President Freeman, Chairman.
John L. Bailey, Vice-Chairman.

1. Paper: General Office Accounting.
   Franklin Heydecke, Newark, N. J.,
   Public Service Electric Company.
   (The treatment of general accounts from an auditor's point of view.)
2. Paper: Accounting for Depreciation.
   H. M. Edwards, New York,
   New York Edison Company.
   (The treatment of the subject from an accounting standpoint, pertaining, however, only to the best practice of handling depreciation through general accounts or special accounts for each class of property. This is not to be a discussion on rates, or how to arrive at depreciation or the basis thereof. Should depreciation be set aside from surplus or built up through

operating expenses, and how and why?)

3. Paper: The extent to Which a Tabulating Machine Can be Used in Accounting Work.
   Wm. Schmidt, Jr., of Baltimore, Consolidated Gas, Elec. Light and Power Co.
   (Relates to use of the tabulating machine for statistical and accounting work; discusses also other labor saving office appliances.)

THURSDAY, 2.30 P.M.

ROOM NO. 1, MAIN AUDITORIUM

Third Commercial Session:

President Freeman, Chairman.
George Williams, Vice-Chairman.

1. Report of Committee on Residence Business.
   Clare N. Stannard, Denver, Denver Gas and Electric Co.
2. Report of Committee on Electric Heating, Refrigeration and Kindred Appliance Sales.
   Frank H. Gale, Schenectady, N. Y., General Electric Company.
3. Report of Committee on Improved Wiring and Equipment Standards.
   M. C. Rypinski, New York City, Westinghouse Elec. and Mfg. Co.
4. Report of Committee on Industrial Lighting.
   M. S. Sloan, Birmingham, Ala., Birmingham Light and Power Co.

THURSDAY, 2.30 P.M.

ROOM NO. 2, FIFTH FLOOR

Third Technical Session:

John F. Gilchrist, Chairman.
W. C. L. Eglin, Vice-Chairman.

1. Report of the Lamp Committee.
   W. F. Wells, Brooklyn, N. Y., Brooklyn Edison Company.
2. Report of the Committee on Prime Movers.
   I. E. Moultrop, Boston, The Edison Elec. Illuminating Co.
3. Report of the Committee on Electrical Apparatus.
   L. L. Elden, Boston, The Edison Elec. Illuminating Co.
4. Paper: Ventilation of Turbo-Generators.
   R. B. Williamson, Milwaukee, Wis., Allis Chalmers Company.
5. Paper: Progress and Development of Self-Cooled Transformers.
   M. O. Troy, Schenectady, N. Y., General Electric Company.

FRIDAY, 10.00 A.M.

ROOM NO. 2, FIFTH FLOOR

Second Power Transmission Session:

President Freeman, Chairman.
J. R. McKee, Vice-Chairman.

1. Paper: Increasing the Flexibility and Reducing the Cost of Operation of Steam Boiler Plants by the Use of Fuel Oil.
   H. A. Wagner, Baltimore, Md., Consolidated Gas, Elect. Light and Power Co.
2. Paper: Determining Cost of Production in Steam Properties under Varying Conditions.
   George H. Walbridge, New York, Central Colorado Power Co.
3. Topical Discussion on Operating Transmission Systems.
   (Several discussions have been prepared.)

FRIDAY, 10.00 A.M.

ROOM NO. 1, MAIN AUDITORIUM

Fourth Commercial Session:

John F. Gilchrist, Chairman.
George Williams, Vice-Chairman.

1. Report of Committee on Electric Signs.
   E. L. Callahan, Chicago, Ill., H. M. Byllesby & Co.
2. Report of Committee on Competitive Illuminants.
   H. J. Gille, Minneapolis, Minn., Minneapolis General Electric Co.
3. Report of Committee on Advertising.
   C. W. Lee, New York City, C. W. Lee Company.
4. Report of Committee on Functions of a Sales Department.
   T. I. Jones, Brooklyn, N. Y., Brooklyn Edison Co.

FRIDAY, 2.30 P.M.

ROOM NO. 1, MAIN AUDITORIUM

Third General Session:

President Freeman, Chairman.

1. Report of Committee on Rate Research.
   John F. Gilchrist, Chicago, Ill., Commonwealth Edison Co.
2. Paper: Elements Affecting the Fair Valuation of Plant and Property.
   W. F. Wells, Brooklyn, N. Y. Brooklyn Edison Co.
3. Papers: Some Reasons for Difference in Price for Different Services.
   N. T. Wilcox, Lowell, Mass., Lowell Electric Light Corporation.
4. Paper: The Standardization of Electrical Selling.
   Douglass Burnett, Baltimore, Md., Consolidated Gas, Elec. Light and Power Co.
5. Paper: Economies in Operation Possible Through Time Study.
   L. B. Webster, Marion, Ind., Marion Light and Heating Co.
6. Report of Committee on Memorials.
   T. C. Martin, New York, Secretary N. E. L. A.
7. Report of Committee on Form of Section Organization.
   Frank W. Frueauff.
8. Vote on Constitutional Amendments.
9. Report of Nominating Committee.
10. Election of Officers.
11. Adjournment.

Illuminating Engineering Society

The New York Section held its regular monthly meeting on the evening of May 11, at which a paper was presented by Prof. R. F. Woodworth, of Columbia University, on "Psychology of Light." Professor Woodworth treated the subject from the strict scientific standpoint, dealing almost entirely with the phenomena of color sensation. The only application of the facts presented was in his discussion of the flicker photometer. In the discussion which followed the fact was dwelt upon that acuity of vision is the most practical means of measuring the value of illumination.

At the Philadelphia Section, Mr. G. H. Stickney, of the General Electric Company, gave a paper on mill lighting.

At the meeting of the New England Section in Boston, Dr. Louis Bell gave a discussion on "Chromatic Aberration of the Eye," in which he brought out the results of the very interesting series of experiments on this subject, and which are commented on elsewhere in this issue.

At the meeting of the Chicago Section, Mr. C. A. Luther, of the People's Gas Light & Coke Company, presented a paper on the lighting of the new office building of this corporation, known as the People's Gas Building, which is not only the largest, but the only modern office building in this country lighted by gas.

Programmes for the June Meetings.

At the New York Section, Mr. Sidney W. Ashe will present two papers, one on a corporation graduate course in illuminating engineering, and one on a comparison of illuminants.

At the Chicago Section, Mr. W. D. Bradley, of the American Luxfer Prism Company, will present a paper on "Natural Daylight Illumination."

At the meeting of the Philadelphia Section two papers will be presented, one on "Gas Ignition," by Mr. Howard Lyon, and one on the "Electric Lighting of a Garage," by Mr. R. F. Zeek.

Southern Gas Association.

The third annual meeting of this association took place in Montgomery, Ala., April 19 to 21. Among the papers presented was one by Mr. Norman Macbeth on "Gas Illumination." A gas show was held for an entire week in conjunction with the meeting, and was very successful.

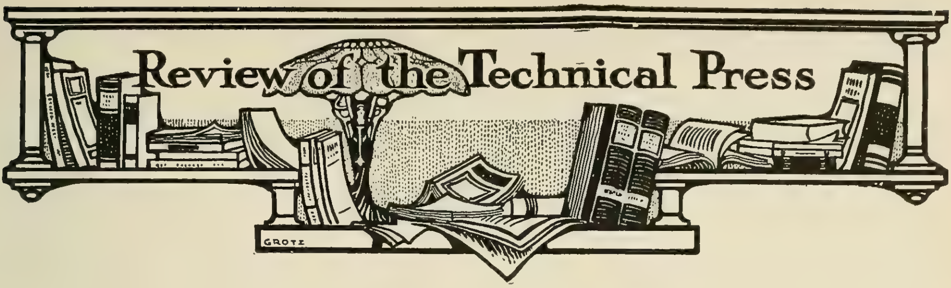
Iowa Electrical Association

At the meeting of this association on April 19 and 20 at the Coliseum, Davenport, as noted in our previous issue, Mr. R. M. Parker presented a paper on "Ornamental Curb Illumination." The writer treated the whole subject from the commercial standpoint, taking up first the question of ornamental posts, discussing their cost and size. The cost of turning on and off installations of this kind was given as 50 cents per month. The interesting statement was made that there are twenty-two cities in Iowa at the present time having installations of ornamental cluster lamp-posts, the total number being six hundred and sixty-two. The average cost per post in nineteen cities is $71 each; the more expensive posts in the larger cities amount from $100 to $125 each. In Charles City twenty blocks in the residential district are lighted with tungsten lamps on ornamental standards.

Nebraska Electrical Association

At the convention of this association held in Lincoln in April last, Mr. C. M. Axford presented a paper on decorative exterior lighting. The reduced cost of operating electric signs with low voltage Mazda lamps was dwelt upon and its advantages in increasing the use of sign and outline lighting in the smaller towns pointed out. He suggested that it was good policy to seek outline installations on buildings somewhat removed from the best lighted streets, thus helping to extend the lighted areas.

The question of glare should be considered in exterior, as well as interior lighting, and to avoid confusing the street illumination with sign and window lighting he proposed that electric signs be placed well up on the buildings. A general discussion of the topic followed the reading of the paper, in which the experience of lighting companies in various cities was brought out.



American Items

New Books

Lectures on Illuminating Engineering; two volumes; cloth; price, $4; Johns Hopkins University Press, Baltimore.

These two volumes contain the full text of the lectures delivered at the Johns Hopkins University under joint arrangement between the university and the Illuminating Engineering Society last October. The various subjects treated upon fairly cover the entire field of the science, and each is the work of a well-known specialist. The course of lectures and the personnel of the lecturers were freely commented upon in this department at the time. It is unnecessary to attempt any elaborate review; the titles of the various lectures and the names of the lecturers are sufficient comment. The volumes form the only complete and authoritative work on illuminating engineering at the present time, and should be the first books on the list of any illuminating engineer or student desiring to qualify for this profession.

The Principles of Scientific Management, by Frederick Winslow Taylor; 144 pages; cloth; price, $1.50 net; Harper & Bros., New York.

Considered strictly by itself, this work has no reference to illuminating engineering. The justification for its review in this department is found in the exceedingly intimate relation which illumination bears to the efficiency of labor. Although scientific management so called is only beginning to catch the ear of the public, Mr. Taylor has been working upon it for some thirty years. His treatment of the subject is clear and interesting to the point of fascination. America is above all things a practical scientific commonwealth, and the application of the same identical principles that have developed American machinery to unquestioned leadership in the world, when applied to the mechanical motions of human labor, cannot fail of producing the same general results. Efficiency of the individual is the one important fact to be constantly observed in this era of high wages. Scientific management as applied to human motion is unquestionably a valuable means to this end, and should be carefully investigated by all who are responsible for the product of human labor. Mr. Taylor's book ought to be read by every factory superintendent and foreman, as well as by the executive officers of manufacturing corporations.

Ornamental Curb Lighting at Hamilton, Ont.; *Electrical World,* April 27.

School and Library Lighting; *Electrical World,* April 27.

A review of the work covered by several papers on this subject before the Illuminating Engineering Society in London.

Chromatic Aberration and Visual Acuity, by Dr. Louis Bell; *Electrical World,* May 11.

The article gives the results of a series of very careful experiments made to determine the effect of the chromatic aberration of the eye on visual acuity. The conclusions reached are that approximately

monochromatic light, such as that of the Cooper Hewitt Lamp, increases visual acuity for a given intensity of illumination for the reason that the rays are brought to a single focus upon the retina. Such a light has a power of revealing detail considerably greater than its photometric intensity would indicate. It acts as if it were a light of much higher candle-power than it really is.

CURB LIGHTING IN FT. WAYNE; *Electrical World,* May 11.

THE ENGINEERING OF INDIRECT ILLUMINATION, by James R. Cravath; *Electrical World,* May 11.

A clearly written and practical article on this subject, which, as the author says, has been little discussed heretofore. The most efficient ceiling is white, and of the tints, cream color is the only one giving satisfactory results; green and gray are more absorptive than they appear. The law of direct reflection applies to a considerable extent to the diffused reflection from ceilings. To determine the number and sizes of lamps, the following rule is given: Multiply the average foot-candles of illumination desired by the area in square feet, and divide this product by the percentage of efficiency. The result will be the number of lumens which the lamps must provide. The lamp manufacturers' tables, which show the lumens for various lamps, can then be used to determine the number of lamps required. The efficiency from the lamp to the theoretical working plane varies from 28 to 37 per cent. in the tests made, according to the size of the room; 30 per cent. efficiency might therefore be taken as a general rule with tungsten lamps, and the most efficient silvered reflectors for the first reflection.

CHARACTERISTICS OF VARIOUS ILLUMINANTS, by H. G. Magdsick; Electrical *World,* May 11.

A letter in which the writer calls attention to the necessity of figuring maintenance costs in comparing the cost of light production by different illuminants. An itemized statement is given comparing the flame arc with 1000-watt tungsten cluster lamps, according to which the total cost of the former is $121.70 for a lighting year of 4000 hours, and the cost of the latter is but $103.63.

ACUITY, by Sidney W. Ashe; *Electrical World,* May 18.

A concise explanation of the general subject of visual acuity, with a brief review of the principal experiments that have been carried out from time to time on this subject. An excellent article for those wishing a plain statement of this interesting subject.

ORNAMENTAL LIGHTING SYSTEMS AT SPRINGFIELD, MO.; *Electrical World,* May 18.

ELECTRIC STREET LIGHTING, by Albert Scheible; Chapters 5, 6, 7 and 8, *Electrical Review and Western Electrician,* April 29, May 6, 13 and 20.

A continuation of Mr. Scheible's serial which has appeared in several issues past of the above publication and which is now concluded with the May 20 issue.

ORNAMENTAL STREET LAMPS IN GRAND FORKS, N. D.; *Electrical Review and Western Electrician,* May 10.

PRINCIPLES OF ILLUMINATING ENGINEERING, by A. H. Rakestraw; *Southern Electrician,* May.

In this installment of the articles on this subject the question of color is taken up. The discussion contains no new matter, but simply the author's method of presenting the subject.

ARC HEADLIGHTS FOR STREET CARS, by P. S. Bailey; *General Electric Review,* May.

PENDANT LAMPS IN A RAINCOAT FACTORY; *Electrocraft,* May.

THE LIGHTING OF A CIGAR FACTORY, by Howard Fink; *Electrocraft,* May.

THE ELMIRA CURB LIGHTING, by E. R. Wager; *Selling Electricity,* May.

A short illustrated article on the new ornamental lighting installation in Elmira.

CAR LIGHTING COST ACCOUNTING, by D. G. Cartwright; *Railway Electrical Engineer,* May.

FACTORY AND SHOP GAS LIGHTING WITH THE REFLEX LAMP, by Robert Herrmann; *Progressive Age,* May 1.

A short illustrated article descriptive of several installations of Reflex lamps in industrial plants in Milwaukee.

RADIATION OF HEAT AND LIGHT FROM VARIOUS LIGHT SOURCES; *Progressive Age,* May 15.

A digested translation of articles on the above subject appearing in the French and German press.

STORE LIGHTING, by B. K. Carling; *Progressive Age,* May 15.

BOWLING ALLEY LIGHTING, by C. H. Wiggers; *Progressive Age,* May 15.

A short illustrated article on the lighting of a bowling alley in Milwaukee, Wis., by gas.

THE BUILDING OF THE PEOPLE'S GAS, LIGHT & COKE COMPANY, CHICAGO; *American Gas Light Journal,* May 8.

An illustrated article describing the new Peoples' Gas, Light & Coke Company Building in Chicago, showing illustrations of the new combination direct and indirect lighting fixtures used in this installation.

INVERTED MANTLE STREET LIGHTING UNITS; *American Gas Light Journal,* May 22.

HOTEL LIGHTING BY INCANDESCENT LAMPS, by Roscoe Scott; *Hotel Bulletin,* May.

Another of this very interesting series of articles contributed by Mr. Scott and covers the subject of indirect illumination.

LIGHTING OF THE OFFICE BUILDING, by Roscoe Scott; *Building Management,* May.

This is the second of a series of articles contributed by this author and covers the subject of the lighting of Upper Corridors.

GAS LIGHTING IN DENVER, by C. Sprague; *National Commercial Gas Association Bulletin,* May.

VALUE OF GAS ILLUMINATION TO COMBINED COMPANIES, by Norman Macbeth; *National Commercial Gas Association Bulletin,* May.

ACCURATE COLOR MATCHING BY ARTIFICIAL LIGHT, by F. S. Tuerk; *Knit Goods,* May.

INTRINSIC BRILLIANCY OF VARIOUS LIGHT SOURCES; *Data,* April.

STEEL MILL LIGHTING; *American Industries,* May.

THE REFLECTING POWER OF VARIOUS METALS, by Wm. Coblentz; *Bulletin of the Bureau of Standards,* May 15.

The results of a careful study of the reflecting powers of a number of metals which had not previously been experimented with in this respect. Of interest only to the scientist.

THE VISIBILITY OF RADIATION—A RECALCULATION OF KONIG'S DATA, by P. G. Nutting; *Bulletin of the Bureau of Standards,* May 15.

A short article giving the results indicated in the title.

A PHOTOMETRIC ATTACHMENT FOR SPECTROSCOPES, by P. G. Nutting; *Bulletin of the Bureau of Standards,* May 15.

A short article illustrated with diagram. Of interest only to theoretical scientists.

SELECTIVE RADIATION FROM VARIOUS SUBSTANCES, by W. W. Coblentz; *Bulletin of the Bureau of Standards,* May 15.

The results of an investigation to determine accurately the energy distribution of some standard light-source in the visible and in the ultra-violet parts of the spectrum. The article is illustrated with many diagrams, and is verv full and complete and of a strictly technical character.

THE SECOND POSTULATE OF RELATIVITY AND THE ELECTROMAGNETIC EMISSION THEORY OF LIGHT, by O. M. Stewart; *Physical Review,* April.

A highly technical discussion of this theoretical subject. Of interest only to the student of pure science.

HOW TO STOP LIGHTING NUISANCES, by James L. Cravath; *Factory,* June, 1911.

The writer gives a number of methods of doing away with the most common troubles with lamp cord, and gives a number of practical methods for adjusting the height of electric lamps. It is suggested that general illumination of sufficient intensity to enable close work to be done is generally better for the eyes than an extremely concentrated directed light.

Editorials

Electrical World:

Subtracted Production of Daylight, May 4.

Periodic Variations of Lamp Filament Resistance.

Direct versus Diffuse Light, May 4.

Chromatic Aberration and Visual Acuity, May 9.

Visual Acuity, May 18.

Electrical Review and Western Electrician:

Displacing Welsbach Street Lamps by Tungstens, April 29.

Electric Car Lighting, April 29.

Railway Electrical Engineer:

Car Lighting and Electric Traction, May.

Engineering Record:

Sterilization of Water by the Quartz Lamp, May 6.

Foreign Items

Compiled by J. S. Dow.

Illumination and Photometry

A Note on Illuminating Engineering Nomenclature, by A. Blondel (*Illum. Eng.*, Lond., May, 1911).

The author expresses disagreement with the suggestion that a system of secondary units of "surface brightness" expressed in foot-candles should be employed to denote the equivalent of specific intensity in illuminating engineering. He presents a complete series of definitions and symbols substantially the same as those advocated by the sub-committee of the Illuminating Engineering Society (U. S. A.), several additional definitions and terms being, however, added.

The Hygienic Aspects of Illuminating Engineering: Illumination and Recent Progress in Illuminating Engineering, by L. Gaster (paper read before the Institute of Sanitary Engineers, April 10).

A paper dealing with the sanitary aspects of illumination in general terms. Special stress is laid upon the connection between health and abundant light and the effect of illumination in promoting cleanliness and in combating consumption. Sanitary engineers, it is suggested, ought now to take a keen interest in lighting conditions just as they have been forced to do in ventilation, pure air, adequate water supply, etc.

The Lighting of Schools and Colleges, by L. Gaster and J. S. Dow (*Illum. Eng.*, Lond., May, 1911).

This is the completion of the series of data on this subject presented at a meeting of the Illuminating Engineering Society in a previous month. Full particulars of the illumination, the nature of the fixtures, the consumption, etc., are given, and the paper concludes with a note on window lighting.

The Ratio of Light to Illumination, by Haydn T. Harrison (paper read at a meeting of the Illuminating Engineering Society, London, on April 24; *Illum. Eng.*, Lond., May, 1911).

The paper contains some popular definitions of terms commonly used in illuminating engineering, and reference is made to some fundamental points in connection with the effects of reflection from wall papers, etc., in interiors.

Notes on Illumination by Gas and Electricity, by F. J. Hawkins (paper read at the Junior Institution of Engineers, London, May 10, 1911).

The paper summarizes progress in gas and electricity in a very general manner, and brief reference is made to such subjects as the effect of glare, street, shop and interior lighting, etc.

EINFACHE LOSUNG ZWEIER AUFGABEN DER BELEUCHTUNGSTECHNIK, by F. Steindl (*Elek. u. Masch.*, April 2).

Deals with two fundamental problems in illuminating engineering. The first is the familiar process of calculating the horizontal illumination due to a source having a known polar curve of light distribution and placed at a specified height. The second consists in the determination of mean spherical candle-power by a method similar to those several recently developed and used in the United States.

UEBER LICHT UND WARMESTRAHLUNG DER KUNSTLICHEN LICHTQUELLEN, by W. Voege (*J. f. G.*, April 1).

Describes researches on the heat given out by various illuminants, the results being collected in a table showing the amount of heat developed for a given light by a variety of lamps, both with and without globes.

THE EFFECTS OF WALL PAPERS ON ILLUMINATION, by P. J. Waldram (paper read at a meeting of the Illuminating Engineering Society, London, on April 24; *Illum. Eng.*, Lond., May, 1911).

Describes a series of tests on various wall papers in interiors, showing how the effect of walls and ceiling can be separately examined and the amount of light received from the various sources analyzed. Several ingenious appliances for testing the polar curves of light distribution of sources in position in a room, etc., are described.

STANDARD SPECIFICATIONS FOR STREET LIGHTING (*Illum. Eng.*, Lond., May, 1911).

An article summarizing in an exhaustive manner the various suggestions that have been put forward from time to time on the subject of standard specifications for street lighting. The various forms of contracts are mentioned and the different systems of testing illumination in the streets (*e.g.*, in vertical, horizontal and inclined planes measuring candle-power or illumination, etc.) are discussed.

LAMP-POSTS AND LAMP COLUMNS (*G. W.*, April 22).

MINERS' LAMPS (*Times' Engineering Supplement*, April 26).

Electric Lighting

DIE ENTWICKLUNG DER GLÜHLAMPENTECHNIK, by B. Momasch (*E. T. Z.*, March 30).

A readable article summarizing the progress in metallic filaments during the last few years. An interesting reference is made to drawn wire tungsten lamps, and the question is raised whether the phenomena which occur when a tantalum lamp is used with alternating currents will also be experienced with filaments of this nature.

LA NUOVA LAMPADA A FLAMMA A LUNGA ASCENZIONE T. L. CARBONE, by A. Pugliese della A. E. G. (*Atti della Assoz. Elettr., Italiana*, March, 1911).

THE NEW CARBONE (A. E. G.) ARC LAMP, by S. A. Rumi (*Illum. Eng.*, Lond., May, 1911).

Both these articles deal with a new form of semi-enclosed flame arc lamp. The essential feature is the provision of certain zones at the base and the top of the lamp where fumes can deposit; but the portion of the globe adjoining the arc is kept so hot that no sensible deposit can take place here so that the light is not interfered with.

LE TRANSFORMATEUR HEGNER (*Lum. Electrique*, March 25).

The difficulty in the use of transformers for house circuits, in order to reduce the supply P. D. and thus use low voltage lamps, is that, while the arrangement is efficient when all the lamps are on, the no-load current is considerable and the power factor is often inconveniently low. It is therefore suggested that a condenser should be put in parallel with the transformer; by this means the power factor is improved and the no-load current considerably reduced.

FORTSCHRITTE DER GLÜHLAMPEN INDUSTRIE (*Z. f. B.*, March 10, 20; April 10, 20).

A serial article describing recent patents on metallic filament manufacture and support.

Gas, Oil, Acetylene Lighting, Etc.

DIE SELTENEN ERDEN MIT BESONDERER BERUCKSICHTIGUNG DER THORIUM INDUSTRIE, by C. R. Böhm (*Z. f. B.*, April 10).

UEBER LUFTGAS, by Busch (*J. f. G.*, April 8).

THE PASSING OF THE ILLUMINATING POWER TEST, by A. Grebiel (*J. G. L.*, April 25).

UPRIGHT VS. INVERTED BURNERS (*G. W.*, April 15).

BEITRAG ZUR FRAGE DER STRASSENLANTERNENFERNZÜNDUNG, by Othner (*J. f. G.*, April 22).

PETROL AIR GAS, by E. Scott Snell (*J. G. L.*, April 18).

In this lecture there is an interesting analysis made of the requirements in petrol air gas lighting. A striking suggestion is that the vapor ought to contain at last 6 per cent. of petrol, so as to avoid the danger of an explosive mixture being generated.

SOME MODERN ASPECTS OF GAS, by W. Upton (*G. W.*, April 1).

A NOVEL PARTNERSHIP FOR HOLBORN (*J. G. L.*, April 18).

Comments upon an interesting incident in connection with the public lighting of Holborn (London), where tenders have been put in by both the local gas and electricity supply companies in competition. After consideration together these companies have drawn up a joint specification, arranging for the streets to be lighted partly by gas and partly by electricity. This co-operation between gas and electricity concerns forms a most novel precedent in Great Britain, and is pointed to as a remarkable instance of the growing toleration between competitors and the influence of the illuminating engineering movement.

THE HAWES DISASTER AND GAS LIGHTING (*J. G. L.*, April 18; *G. W.*, April 1).

A summary of the report of the Board of Trade inspector on a railway disaster in which the collapsed carriages were ignited by burning gas. It is pointed out that the circumstances were peculiar, as this does not appear to have occurred before, and a number of suggestions for strengthening the gas cylinders, etc., are made for future observance.

TENNIS BY HIGH PRESSURE GAS LIGHTING (*Illum. Eng.*, Lond., May; *J. G. L.*, April 11).

One of the most interesting gas installations recently put up—namely, the artificial illumination of a large covered area containing three lawn tennis courts by high pressure lamps. Eight high pressure lamps, each stated to consume 25 cu. ft. of gas per hour and to yield 1500 c.-p., are allowed to each court. The resulting illumination over the courts is said to be very even and satisfactory for playing. Special means are taken to avoid glare, the lamps being hung 25 ft. high and a plate of diffusing glass inserted beneath each mantle, which is, therefore, incapable of being seen by the players.

WESTMINSTER PUBLIC LIGHTING (*J. G. L.*, April 18).

EXCESSIVE CALORIFIC POWER STANDARDS (*J. G. L.*, April 25).

CENTRALLY HUNG GAS LAMPS IN THE CITY (*J. G. L.*, March 28).

GAS AND ELECTRICITY CLASSES IN ROME (*J. G. L.*, March 28).

HIGH PRESSURE GAS LIGHTING IN PARIS (*J. G. L.*, March 28).

THE ESSENTIALS OF A GOOD ATMOSPHERIC BURNER (*Acetylene*, April).

HOME OFFICE REGULATIONS FOR ACETYLENE (*Acetylene*, April).

Contractions used:
Elek u. Masch. Elektrotechnik und Maschinenbau.
E. T. Z. Elektrotechnische Zeitschrift.
G. W. Gas World.
Illum. Eng. Lond. Illuminating Engineer of London.
J. f. G. Journal für Gasbeleuchtungund Wasserversorgung.
J. G. L. Journal of Gaslighting.
Z. f. B. Zeitschrift für Beleuchtungswesen.

The Illuminating Engineer

Vol. VI JULY, 1911 No. 5

PATRIOTISM AND HEALTH

American life has crystallized two customs, the operation of which is now imminent—viz., the explosion of patriotism which we call "the Fourth-of-July," and the summer vacation. The joy of noise is something which we never like to quite outgrow, perhaps for the reason that it is so essentially youthful in its nature. There is no need of softening the words of the psalmist, "Make a joyful NOISE unto the Lord."

The noisy Fourth is an inheritance of the days of war with gunpowder, and this agent of destruction has never been entirely tamed. Every recurrent Fourth has left its list of dead, and a still larger number of those left in perpetual darkness. It is well that this wanton sacrifice of the most precious of the senses should be curbed. The national movement toward a "sane and safe Fourth" is in line with modern ideas of preservation and conservation, both of the individual and of society, in place of the old-time policy of destruction. Love of country is not incompatible with love of one's own health and well being.

The vacation custom far better typifies modern civilization; it is distinctly an effort toward health and refreshment of the entire being. And not the least of the considerations in this respect is the great benefit which the eyes receive in being for a time free from the exacting and fatiguing efforts of close work, and from the relaxation which they receive in the contemplation of distant objects of soft and pleasant hues.

And this invaluable assistance to the most important organs of the body should be consciously fostered. Give the eye the full measure of rest along with the muscles and other far less delicate structures. He who does not return from his outing with stronger eyes has missed one of its most vital advantages.

GIVE THE EYES THEIR FULL SHARE OF REST.

E. L. Elliott.

Illumination of the World's Largest Steamship

The international contest for ocean supremacy in the mercantile marine has been transferred from speed to size. Increase in speed beyond a certain point can be obtained at a cost out of all proportion to the gain, and as the various steamship lines cannot afford to race for mere sport their prime object of earning dividends has compelled them to turn their attention to increase in bulk and thews. The limits in this direction have apparently not yet been reached, for the latest, and therefore largest, of the ocean steamers, the *Olympic*, had not yet touched our shores on her maiden voyage when we heard of a commission being placed by a competing line to build another ship nearly one hundred feet longer, and proportionally larger. And the great Chelsea docks, which have been occupied but a few months, and were supposedly built for generations to come, are already being extended in order to measure up to the demands of their patronage.

Besides mere dimensions, moreover, the different contestants in the race for supremacy are seeking to outdo their competitors in the number and quality of luxuries provided. What with elevators, *a la carte* restaurants, Turkish baths, swimming pools, and gymnasiums, in addition to the traditional salons, reading and smoking rooms, and suites of private cabins fitted with every elegance of the finest of metropolitan hotels, it would appear that the only thing lacking to make the wayfarer forget that some hundreds of fathoms of salt water stretches vertically beneath him is a section of "great white way," with its flashing electric signs, whir-

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FIG. I.—RECEPTION ROOM.

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FIG. 2.—MAIN DINING ROOM.

ring taxicabs and dazzling illuminations. But let us not be impatient, for doubtless all these attractions, too, will be added in due course; so that Broadway, which New Yorkers like to say reaches to Albany, will also run off the other end of the island to "old Lunnon." As it is, there is not a Broadway comfort or elegance that one need forego in the incident of crossing the "big pond."

It is a serious, if not a solemn, thought that man, by following the "mode of thought" which constitutes science, has completely conquered that element of nature which is the very emblem of its might; for statistics show to those who demand proof that, so far as safety to life and limb is concerned, an ocean steamer afloat surpasses all other places. In contemplating this modern supremacy of man over the elements we are lead to regret that Victor Hugo, whose wonderful imaginative perception loved to dwell upon the impotence of man in the presence of the powers of nature, particularly as expressed in the fury of an ocean storm, could not witness this masterpiece of human power, and give us, as only his wonderful powers of diction were capable, an adequate expression of the relation of science to nature. The "toilers of the sea" to-day are not insignificant weaklings wrestling with a force of overwhelming magnitude, but proud and confident masters, bidding not the waves to be still, but defying them to do their worst, and retiring to the more than Oriental magnificence of their ocean palace to make the night merry and to sleep in peace.

Numerous figures could be given to show the vastness of the *Olympic,* but they would mean little, except to those who are either well versed in marine architecture or blessed with an exceptionally powerful creative imagination. The steamer is, roughly speaking, a sixth of a mile in length, and 95 feet in width, practically the distance of five ordinary city lots, and, while every effort has been made to cater to the comfort of the passengers, the vessel, so far as construction is concerned, is not a pleasure craft, but

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FIG. 3.—SMOKING ROOM.

built for business. No space is wasted; the various rooms that are used in common are spacious, which is necessary in order to accommodate the vast number of people that the vessel is intended to carry. The height of the ceilings, or, in nautical language, the space between decks, is ample under the circumstances, but naturally less than is common in land architecture.

The first impression of the furnishings and decoration of the steamer, as compared with those of an earlier day, is greater elegance and better taste rather than greater comparative expense. There is nothing gaudy, no tinsel and veneer, no aggressively apparent efforts at magnificence. Nowhere is there a suggestion of overdoing, of a conscious effort to be grand.

All of these observations may or may not be a fitting preliminary to a critical study of the use of artificial light in connection with this supreme creation of modern science and art. And here, to our sorrow, we are obliged to record a keen disappointment. It is true that the conditions are peculiar and the limitations imposed rather severe; but this affords only the greater opportunity for the display of original genius, and it must be admitted that the lighting installation as a whole is woefully lacking in any such exhibition of originality. The illumination provided possesses some of the most prevalent faults, and the fixtures are generally trite and commonplace.

We may begin with the reception room, which lies amidships on deck D, the decks being lettered from the top downward. From this the main staircase leads to the upper and lower decks, while the main dining room is entered on the opposite side. A view of this is shown in Fig. 1. The ceiling and columns here are white, and the illumination is by ceiling bowls of cut glass containing clear bulb tantalum lamps. An elaborate candelabrum caps the newel post of the central baluster. While the illumination is no worse

than in any number of elegant hotels and private residences, it is far from measuring up in appearance to the elegance of its surroundings, and is unequivocally bad from the practical standpoint in giving a large number of dazzling points that confront the eye from every direction.

The main dining room, of which a section is shown in Fig. 2, is finished in the same manner, and similarly illuminated.

A corner of the smoking room is shown in Fig. 3. The main illumination here is by ceiling fixtures of the chandelier type, the metal work in dull gold and the tantalum lamps being equipped with stalactites of cut glass. Side brackets with imitation candles are added for decorative effect. The woodwork here is of dark mahogany, and the ceiling of a buff tint. It is interesting to note the reflections of the lighting fixtures that show in the glass of the picture over the mantel.

Adjoining the smoking room, which is on deck A (the upper deck), is a small room known as the veranda café, or palm room, which is shown in Fig. 4. The ceiling here is white, and the illumination by round frosted lamps on short decorative sockets, attached to the ceiling. Brackets with upright ornamental globes near the ceiling are also used.

The lounging room on the same deck is shown in Fig. 5. Here there are several ceiling fixtures, which, to a certain extent, may be excepted from the general charge of triteness. They are oval in form, to correspond with the panels in which they are placed, and of a form shown in the illustration. The glass segments are richly cut, as are also the surrounding stalactites. While they are still open to the charge of producing dazzling spots, they have the counterbalancing merit, if such it be, of giving sparkle and brilliancy. Side brackets bearing electric candles are also plentifully used.

In Fig. 6 we have a view of one corner of the reading room. Both side walls and

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FIG. 4.—VERANDA CAFÉ, OR PALM ROOM.

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FIG. 5.—LOUNGING ROOM.

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FIG. 6.—READING ROOM.

ceiling of this room are in pure white. The illumination is by beaded bowls on the ceiling, with side brackets bearing candles equipped with silk shades. There are individual lamps at the writing desks. One cannot contemplate spending a couple of hours under this illumination, with even the most enticing of novels, without anticipating the burning eyes that must surely result from the glare from the dazzling points of light above.

In the more spacious staterooms beaded or cut glass ceiling bowls are used, but in the majority of rooms only frosted lamps studded in the ceiling are to be found. Side brackets are also used, but are so placed as to give but poor results for the purpose. The one redeeming feature is a reading light at the head of the beds. The companionways are lighted with small cut glass bowls appropriately set in the deep panels of the ceiling.

So far as the decorative effect of illumination is concerned there has been an effort, conscious or otherwise, to produce glitter and sparkle rather than softness and harmony, and this ill accords with the general air of quiet refinement which characterizes the decorations. There is not a room in which the eye would not be sorely tried by the constant encounter of numerous brilliant points. While electricity has been turned to every possible account in other respects, it has far from realized its possibilities in the way of illumination. In this respect at least there is a golden opportunity for the next in succession of mistresses of the sea to score a complete victory. Let the next largest ship be illuminated in a manner befitting the progress shown in engineering and naval architecture.

Warren's Night Illumination

By Philip S. Dodd.

Special interest always attaches to *first* things. The City of Warren, Ohio, claims the distinction of being the first city in the United States to light its streets exclusively by Mazda or tungsten filament incandescent lamps. Warren's incandescent lighting system differs from all others, in that it embraces the entire city. On the evening of June 7 the opening of the new lighting system was celebrated by a gala carnival. But that is getting ahead of the story. It is first in order to give a brief outline of the recent history of street lighting in Warren.

Two years ago the city's lighting contract with the local lighting company expired, and the city fathers were about to authorize its renewal on an enclosed basis. The city at that time was lighted by open carbon arcs. The Board of Public Service, then composed of Messrs. Z. F. Craver, J. W. Biggers and Homer C. Reid, was instructed by the council to have plans and specifications prepared for enclosed arc lighting and a Cleveland engineer was secured to draw up such specifications. Bids were to be opened upon the specifications when Mr. E. W. Gillmer, since deceased, suggested that it would be well to investigate the advisability of an incandescent lighting system, be-

FIG. I.—TYPE OF THREE-LIGHT STANDARD.

fore proceeding. The board concurred with Mr. Gillmer's suggestion and conferred with Mr. Hoit and Mr. Hall from the engineering department of the National Electric Lamp Association, who studied the conditions and made an estimate of the cost of incandescent lighting on the basis of 1,000 lamps. At a later date, Messrs. Hall and Hoit submitted blue-prints of the proposed incandescent system to the board and offered to put in a trial installation of incandescent street lighting if the Warren Water & Light Company would co-operate. The outcome of this was a staggered system of lighting on Park Avenue, using tungsten filament lamps on goose necked brackets with regularly fluted reflectors. On account of the general favor with which this trial installation, as well as a similar installation which was placed on Mahoning Avenue, was received by the citizens, the Board of Public Service determined to have complete specifications drawn up on incandescent as well as enclosed arc lighting and to receive bids on them.

Messrs. Hall and Hoit drew up tentative specifications which were thoroughly discussed, with the result that it was decided to adopt the straight line arrangement of units instead of the staggered arrangement in the residential part of the city. Finally, owing to the complete success of the trial demonstration on Park Avenue, after it had been in service for some months, the specifications for enclosed arcs were entirely abandoned, and it was decided to use metal filament incandescent lamps entirely.

Before taking up in detail the description of Warren's new lighting system, it may be well to state that besides the engineers above mentioned the undertaking has been greatly assisted by Mr. Inman, manager of the central station, who superintended the installation of poles and wiring, and by Mr. Bert C. Smith, City Engineer, who was responsible for the location and spacing of the units.

The most interesting part of the instal-

FIG. 2.—ORNAMENTAL LIGHTING. DAY VIEW OF MARKET STREET, LOOKING EAST.

FIG. 3.—ORNAMENTAL LIGHTING. NIGHT VIEW OF MARKET STREET, LOOKING EAST.

lation is located in the central business district. Here there are 86 ornamental standards of the style shown in Fig. 1. Twenty-two of these placed around the spacious public park are single light units. Directly in front of the Court House, near the center of the park, are two 5-light standards. The remainder of the 86 units are 3-light standards. The pendant lamps are of 40 c.p. and are enclosed in 12-inch Alba globes, while the upright lamps of 80 c.p., with the exception of 19 on the single light standards which are 60 c.p., are enclosed in 14-inch Alba globes. The spacing of units varies for the different streets according to their importance as regards traffic, but depends also to some extent on shade trees. The spacing is uniform on any given street and varies from 65 to 80 feet among the various thoroughfares. A midnight schedule is in force for the pendant lamps, but the top lights are burned all night. There are eight standards at each street crossing, the posts being set at the intersection of the curb line with the street line exended.

At the opening of the lighting system on Wednesday evening, June 7, the down-town streets were filled with a merry crowd, estimated at from 15,000 to 18,000 people—a jolly assemblage. Delegations from Youngstown, Niles, Cleveland and other cities were present. At 7.15 o'clock Mayor Craver came to the front of the reviewing stand and introduced the Hon. J. J. Sullivan of Cleveland, who delivered the address of the evening. At the conclusion of this address Mayor Craver threw the switch that turned on the street lighting amid loud cheers from the spectators. The turning on of the lights was a signal for the big carnival parade, which was participated in by fully 2,000 people. Prizes were given for the best costumes and most original displays in the parade.

Among the floats which attracted most attention were the five designed to show "The Evolution of Light." On the first

of these floats was seated a company disguised as Indians gathered around the camp-fire; the second float in series was typical of the year 1620, showing the tallow candle as the method of illumination; the third float represented the period of 1845 with the oil and gasoline lamps; the fourth float showed the period of 1896 with carbon incandescent lamps as the means of illumination, and the last float in this series represented the present ornamental system with Mazda or tungsten filament lamps. This last float was displayed on a huge electric truck showing the layout of the lights around the city park. Another float which may well be mentioned was that of the Water & Light Company, which was loaded with the old arc light dynamo and a number of the old arc lamps, which were tagged with placards bearing the words "Gone For Sure," "Dead One" and "15 Years Service."

FIG. 4.—ONE OF THE FLOATS.

Warren has demonstrated that in her case, at least, the incandescent system of street illumination is practical and highly satisfactory as a means of lighting an entire city. It is encouraging, indeed, to see that such an epoch in the development of street illumination in this city was fittingly recognized and celebrated by the whole community.

How a Southern Lighting Company Takes Its Own Medicine

There is an old saw setting forth the failure of the preacher to practice his own doctrines, and of the doctor to take his own medicines. While these allusions probably refer more particularly to human fallibility in general, they carry at least a shade of suspicion of a lack of faith on the part of the professions mentioned in the efficacy of their own knowledge. Purveyors of electric current and gas are strong advocates of the use of light as a method of publicity, and the exercise of that fullness of consistency, the lack of which has been made proverbial, would necessitate their making a correspondingly large use of electric signs and gas illumination in advertising their own wares; and to a large extent this is true. A shining example is that of the gas and electric company of Bristol, Tenn.-Va. This company has recently opened a new and elaborate office and showroom, and has furthermore made liberal use of light on the outside, a view of the building being shown in the illustration. The electric

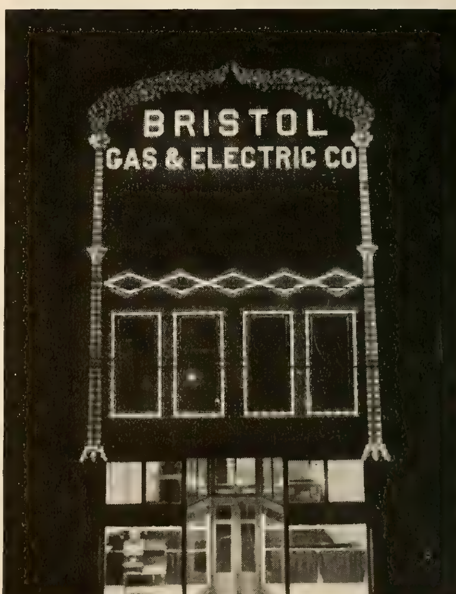


FIG. 1.—BRISTOL GAS & ELECTRIC COMPANY OFFICE AT NIGHT.

sign contains 1500 lamps—300 red, 300 green and 900 white. The immense torch on the top of the sign is rendered lifelike by twinkling red lights, while white lights zig-zag across the face of the building, like a streak of lightning between the green pilasters. The whole effect is both artistic and startling. Whatever other objection the solicitors of this live company may meet they will certainly not be advised to either practice what they preach or take their own medicine.

Further Progress of the "Gas White Way"

Gas lighting with modern incandescent lamps is unmistakably asserting its rights to a place in the boom for better street lighting which has been sweeping the country for the past two or three years. It is stated as a positive fact that when a gas company proposed to erect a new gas holder in a suburban section of one of the large Eastern cities, the superintendent of a school some half mile away protested on the ground that the noise of the gas holder would disturb the pupils. The gas interests have made about as much noise in their efforts to get in on the new street lighting movement as the tanks which hold their product; and as one of our gas friends well put it, " the only thing comparable to the gas tank for uproar is the sphinx and pyramids."

But even " their friends the enemy," the electric interests, now generally admit that there are unmistakable signs of life in the gas camp. As an instance, the installation of gas lamps recently installed on North Clark Street, Chicago, may be cited. A night view of this is shown in Fig. 2, and a day view, which shows the detail of the lamps and posts, in Fig. 1. To outside appearance the lamp is the familiar boulevard type, which has been so extensively used in this country for many years. A closer inspection, however, would reveal the fact that the boulevard globe surrounds a lamp of distinctly modern construction, using the inverted burner principle. This is a new lamp that has recently been developed and is just being introduced for actual use. There are two mantles to a lamp, and as shown, two lamps to a post. The remarkable uniformity, as well as entire sufficiency of the illumination on the roadway and sidewalk is clearly brought out in the photograph, as also the illumination on the fronts of the building.

FIG. 1.—ORNAMENTAL GAS LAMP STANDARDS, CHICAGO.

Another equally successful, and perhaps more decorative installation is that put up by the gas company in Vancouver, Wash., a view of which is shown in Fig. 3. The posts are of cast iron, of an exceptionally good design, embodying simplicity with artistic lines. The posts are finished in white enamel giving them a very striking appearance both by night and by day. It is rather peculiar that the use of white posts in " White Way " installations has not become more common, for they are certainly appropriate as well as pleasing. These posts are put up in direct competition with the local electric lighting com-

FIG. 2.—NIGHT VIEW OF ORNAMENTAL GAS ILLUMINATION IN CHICAGO.

FIG. 3.—ORNAMENTAL GAS STANDARDS IN VANCOUVER, WASH.

FIG. 4.—DAY VIEW OF ORNAMENTAL GAS LIGHTING STANDARDS IN A SUBURB OF PUEBLO, COLO.

pany, under contracts with private parties. It is reported that the number of gas posts is double that of electric posts at the present time, which is proof positive that gas illumination needs but to be adequately presented and *re*presented in order to hold its share of patronage.

Still another successful instance of modern decorative street lighting by gas is that of Pueblo, Colo., night and day views of which are shown in Figs. 4 and 5. This installation covers a stretch of three blocks, and consists of twenty-four posts. Owing to the fact that the blocks are not of uniform length on opposite sides of the street the posts could not be uniformly placed, but they are approximately seventy-seven feet apart, each post being equipped with a three-mantle inverted arc with an alabaster globe. The posts are finished with aluminum paint, giving a fresh and handsome appearance to the installation by day. Besides this particular installation there are two other blocks similarly equipped in another section of the town.

The night view is particularly impressive for the remarkable brilliancy on the pavement as well as the uniformity of illumination. There is no doubt that this is street illumination as well as decorative lighting. That the photograph is a *bona fide* night view is shown by the black sky and the dark upper portions of the buildings.

These three blocks are in a suburb of the main city, and the pride of the local merchants found expression in a general jollification on the evening when the lamps were formally turned on. Dodgers had previously been posted throughout that quarter of the city announcing the event, and a band was brought into requisition in the evening. As a result there were four or five thousand people on the street, which brought so much life and business to the merchants that they have arranged to repeat the concerts monthly during the summer, thus exemplifying the old proverb that " One good turn deserves another ": good lighting brings both good music and good business in its wake.

As another item it may be mentioned that though these posts are five miles from the gas works, the company has had no trouble in maintaining the requisite pressure.

An installation of "White Way" lighting by gas which antidates the electric systems that have created so much comment, and which has passed almost unnoticed, is to be found in Cleveland, Ohio. This installation is on Superior street, the widest business avenue of the city, extending from the river to the public square. It consists of posts equipped with three boulevard globes, each containing two upright mantel burners of the type commonly used in street lighting. More recently electric arc lamps have been put up for several blocks beyond. The gas lighted portion of the street has no reason to fear comparison in point of uniformity and brilliancy of illumination. Probably, however, the gas lamps vitiate the air—which may account for the sooty appearance of the older buildings in the city! At least, if the electric interests should make this objection it would probably be tacitly admitted by the gas people.

Leaving the relative merits and demerits of the two illuminants out of the question for the time, the fact that modern gas burners can give highly pleasing and satisfactory results in street lighting, both from the artistic and practical standpoints, is a matter of great importance to many sections of cities in which the street lighting at present is entirely by gas.

There are hundreds of thousands of gas lamp posts now in use in this country, and the efforts of the gas companies to compete with electricity in the more conspicuous and decorative installations cannot help but have a very beneficial effect upon lighting in general, in extending the use of the greatly improved lamps of recent construction into the sections now lighted by gas though in an indifferent way.

FIG. 5.—NIGHT VIEW. GAS ILLUMINATION IN PUEBLO, COLO.

A Remarkable Central Station Lighting Load

By S. G. Hibben.

Saturday, April 22, was a truly exceptional day, even among the dark days with which the city of Pittsburg is often accredited. During all that day, but especially in the morning, the city was enveloped in a black fog of thick clouds and mist, and so dark were the streets and buildings that the electric illumination was as extensive and as necessary as would be the case upon any dark night. Pedestrians in outlying districts, where the street arcs were not burning, found some difficulty in making their way about. Street cars and automobiles made good use of their headlights; the electric signs blazed forth distinctly; all show windows were artificially illuminated; and, in fact, the streets in the business section of the city would have been veritable canyons of gloom without the illumination from the many electric and gas lights.

This darkness over the city lasted from early morning until somewhat after the noon hour, when the fog and clouds were gradually blown away by freshening breezes. The accompanying photograph, taken on Fifth avenue in the heart of the shopping district at 11 a.m. on this particular Saturday morning, conveys an idea of the conditions at that time.

But, aside from the novelty of such climatic vagaries, the point of interest which is intended to be brought out is the effect which such weather conditions have upon the central station lighting loads. The whole story is told in the two figures, and through an interpretation of the curves we can read the recorded history of the electrical illumination at those times.

Fig. 1 represents the fluctuations of power at various times on two different days in a residential district, and Fig. 2 in a similar way gives the power curves in a downtown business district. Reference to Fig. 1 shows that upon the days of April 21 and 26 the current consumption in the residence district was nearly the same for both of these days. Bearing in mind the fact that April 22 was the dark day, we can see the astonishing difference between the current used in the forenoon of that day and in the forenoon of April 27, which was a fairly bright and normal day. Beginning about 6.30 o'clock on the morning of the 22d, the load increased along a very steep curve, and continued high until early in the afternoon, when the clearing weather removed the cause of the sudden drain upon the central sta-

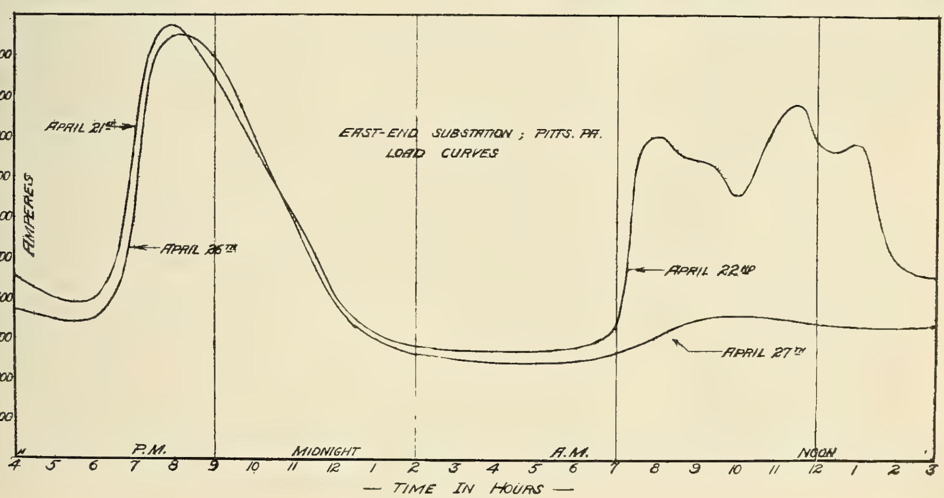


FIG. 1.

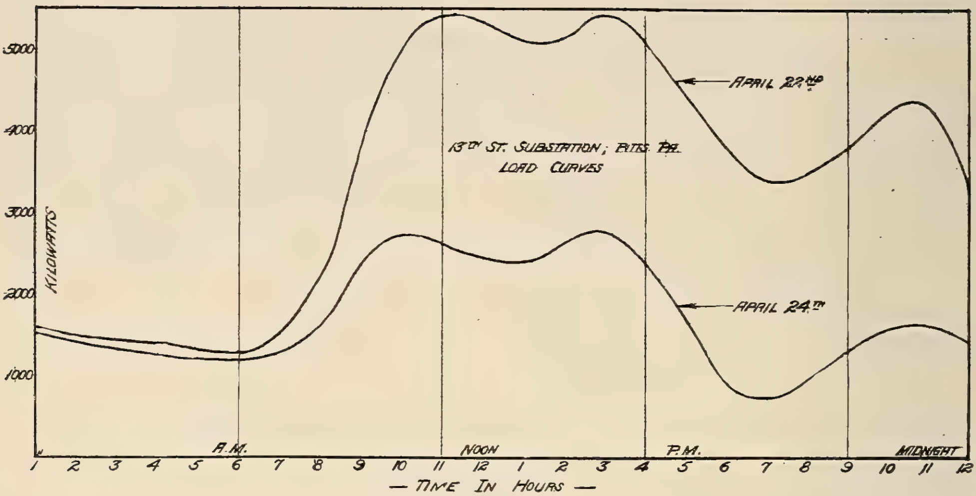


FIG. 2.

tion and the load dropped back toward normal. As would be natural to suppose in a residence territory, when housekeepers are shopping and husbands are at their offices, the day load even on the darkest of days was not as high as it was at nighttime.

The effects of unusual darkness in the

FIG. 3.—PITTSBURG, APRIL 22, 1911.

business district can be interpreted from Fig. 2.

Here we note the near coincidence of the power curves up to 6 a.m. on the mornings of April 22 and 24, but as business men reached their offices between the hours of 6.30 and 10, both curves in rising show an increase in the use of lighting current. But note the more rapid and higher rise of the curve upon the dark morning, as compared with a normal day—April 24. Up until the evening of the 22d the lighting load was more than double that of a normal day. It is interesting also to note the dips in the curves occurring at lunch time, between the hours of 12 and 2.

After the 5 o'clock point, the curves for the two days cannot be rightly compared, since under almost any condition the Saturday night load would be much heavier than the night load upon a week day. That is to say, the normal Saturday night peak load would be about 4400 kw. upon this substation practically the whole summer, but there would be no conditions other than the weather which would cause the load upon the morning of a Saturday to be much in excess of the load at a similar time on a week day.

Given a larger number of days, such as April 22, and the slogan of "procuring day load," would scarcely need to be sounded in Pittsburg. In fact, the central and substations were taxed to their full capacity on this occasion, and be it said that the sudden emergency calling for an exceptional increase in generation of electricity was met with entire success throughout all Pittsburg's lighting system.

The Relative Importance of Illumination to the Business Center of a Modern City

By H. N. McConnell.

We must realize what great strides have been made in the art of street illumination when we read in one of the issues of a prominent newspaper that in 1697 an ordinance was passed compelling every seventh New York householder to hang a lantern on the end of a pole from a front window of his home. The candles in these lanterns were kept burning all night, and the cost of each was divided among seven men. On nights when there was a moon the candles were not lighted.

While ornamental street lighting is desirable the manufacturer should consider that the central station is working for a certain purpose, which is broader than the idea of making the streets of each and every city in the country a copy after a certain cut and dried type.

From the merchant's point of view the proper lighting of his display windows comes first and foremost, since that is his chance to tell his story to the prospective buyer on the street. After having spent considerable money in various types of window lighting, and at last succeeded in striking something effective, the merchant is not particularly pleased to have the entire effect of his windows ruined by a street lighting system, ornamental or otherwise, which produces such a glare from his window glass that the contents of the window are practically invisible from across the street.

I believe window lighting should receive the first consideration in any city; then the electric sign, and after that the design of a system of street lighting which would not detract from either of them. The electric sign is only effective against a dark background.

String flaming arc lamps on your business streets and see the ugly unpainted buildings stand out and the signs lose all their effect.

Quoting from a merchant who some twelve months ago installed window lighting and then an electric sign, he stated that he was "now ready to support street illumination," as he considered the three most important factors in his success were his "cash register, his safe and his electric sign."

It is difficult for the merchant to rea-

lize the tremendous problems which are a part of central station practice, and apparently it is just as difficult for the manufacturer to appreciate them. A great many central stations make the mistake of burdening the merchants with large donations toward street lighting and thereby discourage his interest in window lighting and electric signs, and there can be no question to any one who is familiar with the *practical* side of central station policy but that originality in design of electric signs and window lighting is what gives a city that most desirable quality of *individuality*. It is the quality which differentiates one city from another. As a nation we have been distinctive in all our achievements, and why should we now descend to the commonplace in lighting which has such an important bearing on the status of any city?

The proper system of street lighting is one which lights the street, distributing very little light on the sidewalk and practically none on the upper portions of buildings.

Some Lay Opinions on the Illumination of Iron and Steel Mills

By Roscoe Scott.

The conscious and subconscious opinions of the average wage earner regarding the light that is given him to work by would, if they could be ascertained with certainty, be of great interest to illuminating engineers as well as to psychologists. Information of this kind, however, can be obtained only with difficulty, and at best slowly and inefficiently, if one must get at it by personal talks with employees. A few months ago the author desired to obtain, on rather short notice, some typical expressions of opinion about artificial light from workers in iron and steel mills and decided to adopt the "direct-by-mail" method of communication. This rather novel application of the postal campaign idea elicited a number of replies—some of them amusing—but, taken as a whole, suggestive along practical lines. They are summarized below.

A mailing list of fifty names was prepared with the assistance of the 1910-11 edition of the Cleveland City Directory. The occupations represented by this list of names will be apparent from the following summary:

One boiler maker, one blacksmith, one case hardener, one core maker, one die maker, one drop forger, eight iron workers, sixteen machinists, one machine operator, eight molders, four pattern makers, one steel worker, four tool makers, one wire drawer. The fiftieth letter went by mistake to a man who it was afterward discovered was engaged in an entirely different line of business. The names were picked at random, but this statement should be qualified by adding that Slavic names were omitted, as it was thought that very few replies would be forthcoming from them. The questions asked in the circular letter were as follows:

1. Do you do much work by artificial light?

(The above question refers to work done at your regular trade or business.)

2. When working at night or after dark, is your work so lighted that you can see well?

3. Do you work on a night shift?

4. What kind of lights, or lamps, are provided at your place of business for night work?

5. Can you work as rapidly, and as well, by the artificial light which you now have as you can by daylight?

6. What kind of lights, or lamps, do you think give the best results for your kind of work, and why?

7. Have you any comments to make about the light which is given you to work by?

Replies were received from 36 per cent. of the men to whom letters were sent. All degrees of intelligence and education were indicated and many different schools of caligraphy and orthography. The con-

STRAW BALLOT.

1.-- Do you do much work by artificial light?

Please answer here (Yes or no): Yes

(The above question refers to work done at your regular trade or business.)

2.-- When working at night, or after dark is your work so lighted that you can see well?

Please answer here (Yes or no): Yes

3.-- Do you work on a night shift?

Please answer here (Yes or no): No

4.-- What kind of lights, or lamps, are provided at your place of business for night work?

16 Candle Eletric Cord Light

(Please answer the above question by describing the lights as fully as you can).

5.-- Can you work as rapidly, and as well, by the artificial light which you now have as you can by daylight?.

Please answer here (Yes or no): No

6.-- What kind of lights, or lamps, do you think give the best results for your kind of work and why?

Please answer here: Eletric Cord Light in connection with ceiling Cluster or Arke Light.

7.-- Have you any comments to make about the light which is given you to work by?

No

W. K. Young

FIG. I.—SPECIMEN OF STRAW BALLOT.

clusions drawn from the answers were as follows:

1. About 50 per cent. of the workers do a large amount of work by artificial light, although only two men (iron workers) report that they work on night shifts.

2. About one man in every four complains that when he works at night or after dark his work is not so lighted that he can see well. The percentage of the dissatisfied is even greater in the case of those who report doing a large amount of work by artificial light.

3. Fourteen of the men report that electric lights of one kind or another are used for night work; two report that both electricity and gas are used, and one reports that gas only is used.

4. Eleven men out of sixteen *cannot* work as rapidly or as well by the artificial light which they now have as they can by daylight, and frankly own up to the fact. Two of these men give emphatic negative replies. There is evidently room for a lot of improvement from the worker's point of view. Employers have often claimed that their men worked at reduced efficiency under artificial light: here we have a general admission of the fact on the part of the employee himself. It would manifestly be unfair to blame "electricity" in general for unsatisfactory conditions where they exist—both because the most modern electric lamps have as yet been introduced only to a limited extent, and also because there is nothing to show that if some other source of illumination had been substituted for electricity, the results would not have been as bad, or possibly worse.

5. The replies indicate a great diversity of opinion as to what kind of lights are the best to work by, and little value can be attached to these opinions on a matter of this sort, inasmuch as most men have not had experience in working at their trades under many different kinds of light. Arc and incandescent electric lamps, gas mantles and mercury vapor lamps each had one or more devotees among the tradesmen who gave their opinions.

6. The men who considered their places to be really well illuminated expressed hearty appreciation of the fact.

One machinist writes: "We are furnished a very good shade for our lights, so we have no light shining in our eyes."

An iron worker writes: "They are very prompt about our lights and give us the best that can be had."

The Ultimate Relation of Illuminating Engineering to Public Utility Corporations—An Analysis

I—Motives Governing the Operation of Public Utilities

By F. Laurent Godinez.

While the public utility corporation has as yet failed to receive enthusiastic public approbation as a distinctly benevolent or philanthropic organization, it has, notwithstanding, earned quite universally the respect of every intelligent community. That every public service corporation, and particularly those engaged in the manufacture and dispensation of light are directly interested in the growth, welfare and prosperity of the city or territory in which they operate, is an axiom which cannot be taken exception to by any thinking individual. Moreover, this identity of interest is not only logical, but praiseworthy. The ultimate welfare of the city depends upon the citizen—and the citizen taken collectively represents but a group of individuals which may be influenced to greater or less co-operative effort by a public service corporation, which after all is but a group of human beings—*real men*—not the "malefactors of great wealth" imaginatively caricatured by yellow journalism and fostered in the public mind by ignorance and unreasoning prejudice, but simply human units—correlative factors in the great equation of *life*.

Perhaps one of the greatest difficulties confronting the operators of light-producing corporations is this same strong, but unintentional prejudice on the part of the average citizen, who fails to realize that the mutual welfare, not only of himself, but of his community, is indissolubly linked with that of public utilities. Indeed, there is no possibility of separating them; what helps or hurts one, helps or hurts the other; and when the citizen is unable to use and pay for his light it is the central station which bears the brunt of his misfortune. It is invariably the citizen's privilege when pressed to the wall to retire promptly from business with as much grace as the exigencies of his conditions permit, but this privilege is not extended to the lighting companies, and in the face of unrelenting adversity and general business depression it must continue from day to day, bearing its tremendous losses with grim fortitude, but always holding itself in readiness to instantly supply that "maximum demand" for service which temporarily has ceased to exist.

Of course, none of our public utilities are strictly indispensable on the basis of a retrogressive hypothesis. Presumably they cannot persuade the adoption of gas and electric light in the home where the oil lamp would be regarded as a luxury, and the candle as a necessity, but for that very reason the multiplication of semi-prosperous homes becomes an issue of vital importance in the successful conductance of their business, and this issue can only be faced by a constant enedavor to better the working and living conditions of their communities. Hence, profit from the sale of light may be attained only by expansion, or in the more extensive use of service. And, as the demand for service increases the charge for service decreases; and in no other commodity save gas and electricity is this decrease so marked.

Expansion, however, is fundamentally dependent upon satisfaction—or the efficiency of the service, at least up to a certain point, beyond which any further increment involves what is termed "public relation policy." If this policy be of

broad gauge, maximum expansion, or the more extended and varied use of service becomes attainable, but only in the functional relation, since obviously the full measure of expansion, *i. e.:* the perfect city must forever be our inspiration.

One of the most important factors in any policy of public relations is publicity. The public utility corporations which today enjoy the respect and esteem of their consumers are those who have indulged most freely in the right kind of publicity, the possible exceptions being only those organizations which, while actuated by the best intentions, have advertised their wares not wisely but too well. If it were only possible for a public utility corporation to plan and execute its public policy relations and publicity campaigns without interference from outside sources its community would be greatly benefited; but the continual "insurgency" of a certain undesirable element existent in every center of civilization has considerable bearing on the work. This condition is brought about by those individuals who, like scavangers, feed upon the credulity of mankind. Prominent among their ranks are the "Audit and Rebate" concerns, the "Anti-Wattage-Engineers," or false economists, the corrupt politician, the "authority" on meter performance — the "expert" on maintenance — the lobbyist promoting competitive franchise rights, and the charlatan posing as a "lighting expert" and disposing worthless illuminants and accessories promiscuously. Fortunately it is impossible for these offenders to thrive for long in any particular locality, but with the proverbial alacrity of the flea they skip from spot to spot, leaving their victims sore, smarting, and in a vindicative mood not responsive to commercial overtures of any kind from any source.

It is quite apparent, therefore, that the public utility corporation is confronted with many problems which are of such a complex nature as to require the most detailed consideration before attempting to define in full a public policy relation.

Some Interesting Examples of Lighting Practice in Germany

By R. F. Pierce.

In buildings devoted to commercial purposes, one usually finds the question of economy given first consideration. For instance, the great American department stores, which are quite generally regarded as the highest development of modern merchandising, are almost invariably devoid of architectural beauty, and the illuminating systems bear little or no evidence that esthetic considerations had received much attention. In Germany, on the other hand, it is quite common to find artistic consideration foremost even in the least pretentious business buildings.

In the small tea-room shown in Fig. 1 the units are, for obvious reasons, high efficiency incandescent lamps in plain spherical opalescent globes. High efficiency lamps are, of course, used to secure economy in what would otherwise have been an exceedingly wasteful installation, as the decorative scheme plainly prohibits the use of reflecting shades. An effect of privacy and coziness is secured by alternating arches of incandescent lamps with circular fixtures carrying an equal number of lights, thus cutting the room as far as lighting fixtures are concerned, into several small *cabinets.* It will also be observed that this alternation carries out the *motif* in the frieze. The cords festooned between the individual "drops" comprising the arch are also an essential factor in the artistic effect of the whole.

Fig. 2, like Fig. 1, shows the use of plain spherical globes, which is a more common practice in Germany than in America. The simplicity of German interiors demands lighting fixtures of the same quality, and the necessity of observing this harmony between interior features and lighting fixtures will be at once ap-

FIG. I.—A TEA ROOM.

FIG. 2.—AN EXAMPLE, SHOWING THE USE OF PLAIN SPHERICAL LAMPS VERY COMMON IN GERMAN PRACTICE.

FIG. 3.—THE RUG DEPARTMENT OF A LARGE BERLIN DEPARTMENT STORE.

parent by considering the discordant effect that would be produced by the use of even the plainest of reflectors in the installations shown in Figs. 1 and 2. The relative inefficiency of these installations is, however, greatly reduced by the light ceilings and friezes, and on the whole both are highly satisfactory from both artistic and commercial standpoints.

Fig. 3 shows the rug department of a large department store in Berlin. As the rugs shown are almost entirely of Oriental workmanship or pattern, it is quite fitting that the design of the lighting fixtures should be based upon the hemispherical dome which forms such a striking and characteristic part of Oriental architecture. The beaded rope pendent from the dome serves to conceal the unsightly outlines of the arc lamps which furnish the pure white light required in a show-room of this sort. The incandescent lamps, four in number, surrounding each arc lamp serve to mellow the light, yet are not sufficiently powerful to impair the whiteness of the light delivered upon the floor. It may be noted here that in Germany little trust is placed in the alleged "color matching" qualities of the tungsten lamp.

Another point in Fig. 3, though not at all pertaining to illumination, is the manner in which columns and ceilings are decorated in harmony with the character of the goods shown. Oriental designs prevail throughout, and there can be no doubt, in this particular instance, of the commercial value of such a harmoniously designed show-room. Undoubtedly the rugs show to better advantage in such completely Orietnal setting and even the most casual observer must be more impressed by their beauty. Compare this with the barren lofts which serve the purposes of salesrooms in even the best American department stores.

Fig. 4 shows a novel way of securing both local and general illumination from the same fixture. The dome is covered with translucent fabric on the under side. While anything but a thing of beauty, it serves its purpose well. It would appear

FIG. 4.—AN INSTALLATION IN WHICH THE SAME FIXTURE ACCOMPLISHES BOTH LOCAL AND GENERAL ILLUMINATION.

FIG. 5.—A SALON AT THE SCHLOSS AT POSEN.

at first glance to offer many advantages over the indirect or semi-indirect systems, as the light is adequately diffused without losing " direction," and at the same time may be highly localized.

Fig. 5 shows a salon at the *Schloss* at Posen. It contains nothing of interest as regards the economical or effective use of light. The principal reason for showing it is that it embodies the best of German craftsmanship and enables one to appreciate more fully the great strides that have been made in the development of a *national* decorative art in Germany—distinctive, yet neither narrow nor provincial—modern, yet entirely free from the reckless ugliness which characterizes so much of the work of those who, in seeking to sweep away the influence of all tradition, assume that just because a thing resembles nothing else under the sun, it must be art. The German has from the first built upon classic forms, and his first efforts were stiff and awkward from the severity imposed by the limitations of the foundation, yet he has evolved a national school of decorative art, distinctly Teutonic and expressive of German ideals. This he has done by the only sane and logical means. Not by attempting to create a new heaven and a new earth of art by appropriating anything and everything that happened to serve no other useful purpose, but by taking his materials wherever he found them—as a true artist should—and putting the Teutonic impress upon the whole. While modern German decorative art is singularly free from the trammels of convention, yet it accords perfectly with the ideas of the beautiful in art which tradition has impressed upon us. Simplicity is secured without severity, and the best Teutonic decorative art of to-day meets in the highest degree the demands of modern civilization, combining homeliness (Gemüthlichkeit), utility and refinement. The American designers can learn much by a careful study of the modern German tendency.

Green Glass "Blackboards"

By Albert Jackson Marshall.

The writer, a few years ago, after extended investigation, gave publicity to the theory of using *light tinted* symbols on *dark backgrounds* in printing, instead of the customary *black* on *white* style. In setting forth this theory it was specifically stated that the recommendations *were* light tinted symbols on dark backgrounds, *not* white symbols on black fields; inasmuch as the contrasts afforded by the *light tinted* symbols against the *dark backgrounds* were ample for discernment, far more pleasing, less confusing and generally easier on the eyes than the extreme contrasts afforded by *white* lettering on *black* fields. (For sign work, display, some times extreme contrasts, white on blue or black, etc., are desirable.) As the result of many tests it was felt that the most practical combination of colors was *yellow tinted* symbols on *dark* (non-glazed) *green backgrounds*. The theory underlying the suggestion of *light tinted* symbols on *dark backgrounds* is, that, inasmuch as we are enabled to " see " only by having light rays reflected from an object to the eye, in the use of *light tinted* symbols on *dark backgrounds* the symbols themselves reflect the light, while the backgrounds absorb the maximum flux of light striking their surfaces. Thus we " see " directly the object of our gaze, while with the present method of printing *black* on *white*, the white or light *backgrounds serve as the reflecting surfaces*, while the black lettering *absorbs practically all the light* striking their surfaces. In the use of such latter mentioned method we " see " that portion of the background not taken up by the printing; in other words, *we do not " see " the printing*. It was realized by the writer when this theory was brought out that it would be practically impossible to effect such a revolutionary change in printing without due process of evolution, because the theory would not only have to combat with the prestige of our present mode and the opin-

ions of the skeptics, but likewise the more commercial side—the money invested in our present-day printing apparatus and equipment.

It would appear, however, that an opportunity is afforded for trying out the theory of *light tinted* symbols on *dark backgrounds* through the medium of what we are inclined to commonly refer to as "blackboards" in our schools. Until comparatively recently most of these "blackboards" were made from slate, and as a rule white chalk was used in the marking of same. Some time ago a concern began experimenting with black glass sheets, the exposed surfaces of which were depolished, which were offered as something to supplant the slate type of "board"; these sheets being made from 3-16 to ¾ in. in thickness, with other dimensions to suit standard requirements. The glass is non-absorbent, foreign matter not being able to enter any further into the plate than the mere depth of the pits (caused by depolishing of the exposed—writing—surface); such being the case, the glass is easily kept clean by using an ordinary dampened sponge or "rubber." If a luster is wanted (glazed or polished surfaces for such work should be avoided) a little kerosene oil will suffice. The principal points of excellence of such glass boards are: sanitary; extraordinarily long life; they will not disintegrate; uniformity of structure; adaptability and perfect writing surface. These glass "blackboards" have so far been put out solely in black glass, and are used with white chalk as formerly. It is suggested by the writer that instead of the *black* glass "blackboards," *dark green* "boards" be used, and that *yellow* instead of *white* crayon be employed. It is felt that such a combination would be more desirable from the physiological, psychological and esthetic viewpoints. The experiment could easily be made, and the results of the writer's experiments along these lines would indicate that the end would justify the effort.

The Lighting of a Billiard Parlor

By Melvin Spencer.

It is undoubtedly true that the majority of ideas, novel or progressive, originate in the East, but it would be a source of much surprise for many of us to learn that in several fields the West is quicker to see the value of innovations than the East. There, the country is new, the people are new and their minds are open to new ideas in every activity, once they have proved their worth.

This tendency is shown particularly in the lighting field. In the West, especially the Far West, people have been quick to take advantage of the wonderful improvements of the last two years.

As an example of this progressiveness we might cite the installation in the billiard parlor of Brown & Hulen, Seattle, Wash. In planning this parlor it was the intention of the proprietors to make it the finest billiard parlor in the country, and a glance at the photograph here reproduced will convince one of the carrying out of their intentions.

It occupies the entire floor of a modern building, in a prominent part of the city. The fittings are of the finest, and everything has been looked after to make this an attractive place to spend one's leisure hours in. Twenty-seven tables are symmetrically arranged, and it would be difficult to find its equal in size or attractiveness this side of the Mississippi.

The lighting of this room gave the owners no little concern, they fully realizing the poor lighting facilities of ordinary billiard parlors. Strong, local lighting, directly over the tables, gave the desired illumination on the tables, but materially detracted from the light, cheery appearance of the room, so desirable for a place of recreation.

To secure a strong enough illumination on the tables by ordinary means, without the use of local lights, meant a most annoying glare and an abundance of shadows, most detrimental to the efficiency of the players.

FIG. I.—SEMI-INDIRECT ILLUMINATION IN A SEATTLE, WASH., BILLIARD PARLOR.

The most feasible suggestion seemed to be the use of both local and general lighting, but this was objected to as spoiling the general appearance of the room.

When the use of a direct-indirect fixture was suggested, the idea was scorned as being unheard of and impractical. However, on the strong recommendation of the manufacturer, they consented to try out this idea, and the result exceeded all expectations. The room itself was divided into bays, approximately 30 feet square, and an outlet placed in each center. The fixture used was square, with frame-work of ornamental drawn bronze of Pompeiian bronze finish, from which was suspended a translucent glass bowl. The frame-work was lined with special silver-plated corrugated glass, arranged to throw the maximum light flux to ceiling at proper angles for a bay 30 feet square. The bowl provided a visible source of illumination, relieving the hollow, unnatural appearance of the room, so generally felt when it is lighted by a purely indirect scheme. This bowl in no way produces an annoying glare, as the intensity of illumination is necessarily low, being placed directly below the bottom tip of lamp. The maximum flux of the lamp is directed, by means of reflecting glass, to the ceiling, where it is diffused for general illumination. The result is truly remarkable, as can be appreciated by a close examination of the photograph. This is an unretouched photograph, taken about 3 A.M., after the hall had been cleared, and the upper portion of the room, as can be readily seen, is still filled with tobacco smoke. Every detail is brought out most clearly, even to the minute pattern of the carpet. The illumination is practically shadowless, an absolute necessity in billiard parlor lighting, and the sharp contrast obtainable can be realized by an examination of the distinctiveness with which the billiard balls stand out on the tables in the background.

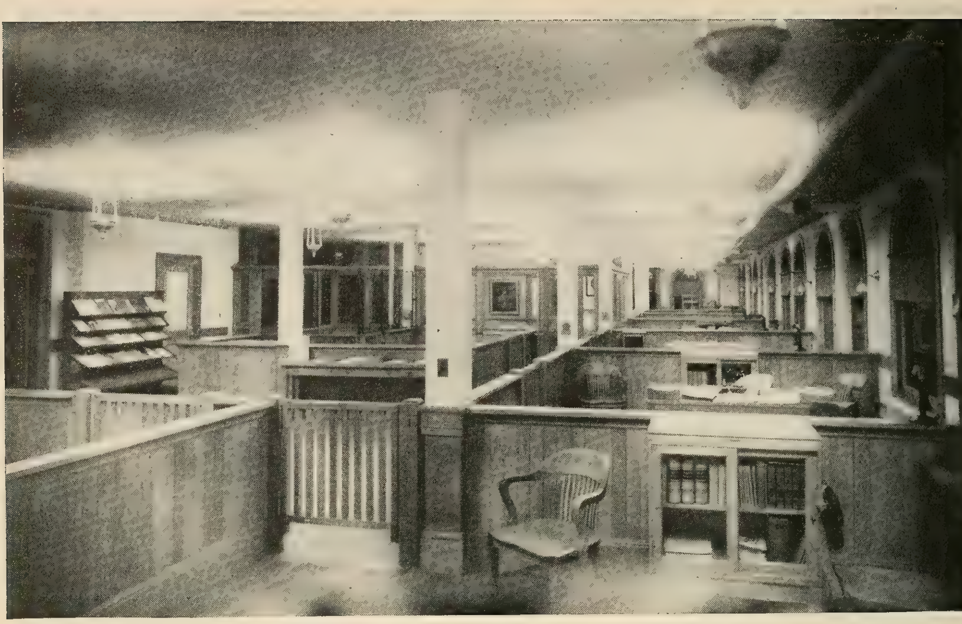


FIG. I.—INDIRECT ILLUMINATION IN A PUBLICATION OFFICE.

Indirect Lighting in a Modern Office

One only has to recall his own individual feelings, upon entering offices of one kind or another, to realize how very important to the visitor is the appearance of the *office as a whole,* whether by natural or artificial illumination.

In fact, we venture, the composite impression which the average man has in his mind of offices, as offices run, is an uneven spectacle of high lights here and low lights there; of people bowed over at their desks in one part of the room, while, on the other hand, some appear half hidden and gloomy of mien because of the unevenness of illumination.

Is that a fair impression, to your recollection, of the offices you visit?

The accompanying illustration shows about as cheerful an installation for the illumination of an office as we have had the opportunity of studying, if for no other virtue than the absence of those dark shadows that are so objectionable.

Here everything appears cheerful. Furthermore, when talking business under an installation of this character one is on precisely the same footing as another. In short, one is in no danger of being seated in the limelight, and made to feel the uncomfortable glare of light thrown in his face, while the other sits with his face in the shadow. But such illumination as above shows the conditions are not only cheerful, but suggest that everything that takes place is seen by all—open and above board.

The installation here shown is in the offices of the National Arts Publishing Company, Boston.

Fixtures and Accessories

Some Further Examples of Western Ideals in Lighting Fixtures

There are some doctors who tell us that all lights must be entirely hidden, for the eyes' sake; and there are other doctors who tell us that we must eat our meat raw, and still others that we should eat no meat at all. If we followed the advice of all the doctors we should all be going in two opposite directions at the same time. It is doubtless unwise to gaze continuously upon a lighted lamp, just as it is unwise to make a full meal out of ice cream, or to stand continuously upon one leg. But if we did all of the things that we ought to do and left undone all the things that we ought not to do, would life thereby become a state of unalloyed bliss? Probably not. There are certain infractions of the physical code and (aside—of the moral code, too) which give such a zest and piquancy in the doing that they may occasionally be taken in small doses like the rank poisons of the doctor's prescriptions without fatal results.

FIG. 2.

FIG. I.

And so we shall probably for some time to come continue to put up lights where we can see them, following the perversity of our fallen natures, for the express purpose of having them there to look at. The practical application of which moralizing is simply that the wall bracket as a lighting fixture has a reason for existence which is likely to keep it in use for some time to come. In fact, if rightly designed and used with discretion it is possible to produce a very satisfactory illumination, even of large interiors, with no other means than lamps on wall brackets. The Maxine Elliott Theater in New York may be cited in evidence. The bracket, however, is not the unit that would be chosen from a purely engineering standpoint, and it is

FIG. 3.

therefore to be found more often in a decorative form than the more utilitarian types of fixtures.

It is well nigh impossible to light a bedroom perfectly without the use of brackets, which afford the best possible means of giving the proper light for seeing one's self in a mirror. Figs. 1 and 2 show brackets which would serve this purpose admirably. They should be finished in silver, and would thus harmonize with silver mounted toilet articles.

Fig. 3 would be equally acceptable in combination with harmonizing wall decorations. It should be finished in dull gold, and the mountings of toilet articles would preferably be of a similar design and finish. The wider spread of the arms adapts it to somewhat larger rooms than the previous examples.

Fig. 4 could be finished in either silver or gold, and used either in a bedroom, reception room or parlor in which the decorations were of the French order.

Fig. 5 shows the same bracket with shades over the candles. Thus equipped the bracket is well suited to the essentially decorative purpose of furnishing an ostensible source of light and bringing up the general balance of decorative features. The silk shades would also furnish a touch of brilliant color, which often gives charm to an entire scheme of decoration.

Fig. 6 is another handsome bracket which could be utilized to advantage in much the same manner, the bead work shades giving the sparkling effect of jewels in place of the subdued light of the shaded candle.

Fixtures of the chandelier type—*i.e.,* intended for support from the ceiling, and

FIG. 4.

FIG. 5.

FIG. 6.

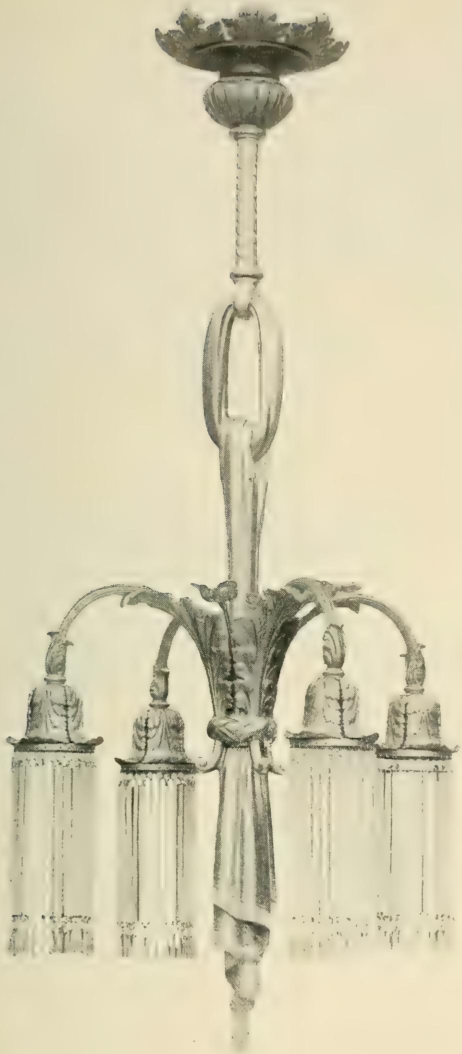


FIG. 7.

in most cases in domestic lighting for use in a central positon—will probably hold their supremacy for many years to come, though they will naturally undergo changes in design and decoration. Fig. 7 shows a fixture of this type in which the stiffness of construction is relieved by a simulation of drapery effect. The long prism decoration of the lamps carries out this motive very successfully, producing a combination that is harmonious and pleasing.

Fig. 8 may be best classified as a novelty. In the angular shape of the globes the glass decoration of the supporting chains and the general construction the fixture diverges radically from both the ordinary chandelier and the "shower." Those who tend to radicalism in their desire to avoid stereotyped forms may find something to their taste in this design.

Fig. 9 is a very successful effort to combine the Mission style of decoration with the "shower" type of fixture. It will be noted that there is not a curve to be found in the entire fixture, the use of geometrical figures and angles being depended upon entirely for the decorative effect.

Fig. 10 is a design which would appropriately find a place in a room of the Arts and Crafts order, although it has a somewhat Teutonic flavor. It is better suited to rooms of rather large dimensions, in which case the bowl and surrounding lamps could be connected to different switches, permitting either or both to be used at will.

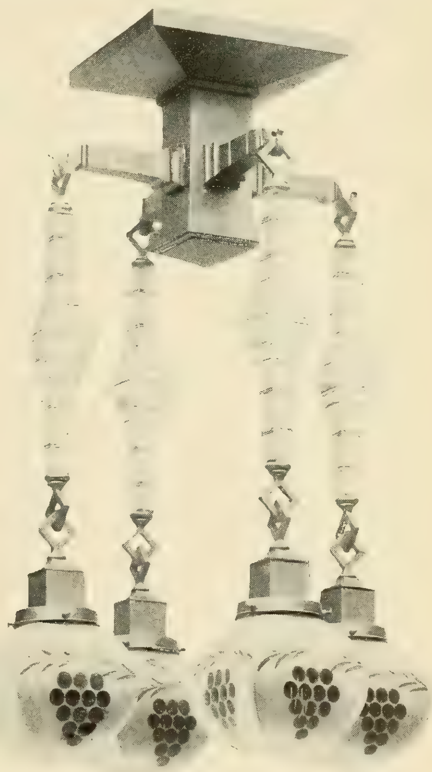


FIG. 8.

FIG. 9.

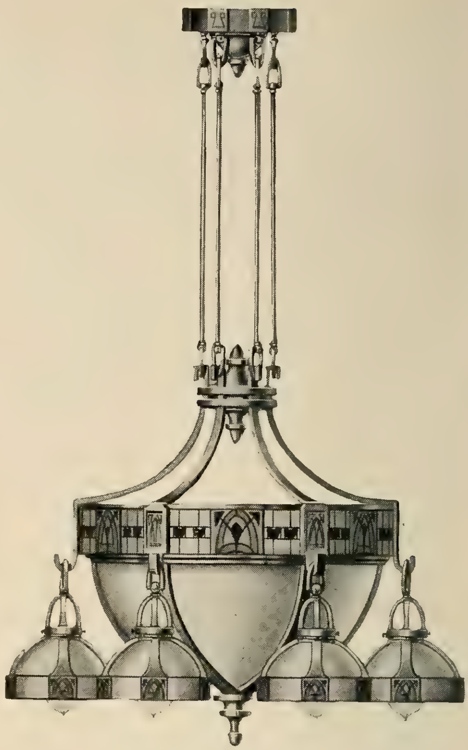


FIG. 10.

In Fig. 11 we have a fixture of the "shower" type in which round frosted lamps are used in place of the usual lamp with diffusing globe or shade. The photograph of this fixture brings out an interesting point in regard to symmetry. On looking at the lamps alone one would say at once that they were arranged in two groups of three lamps each, comparatively close together. An examination of the ceiling plate, however, will show that the lamps are placed uniformly around a circle, the apparent grouping being the result of perspective. In this case the effect is one of balance, and no harm is done; but in case of an unequal number of arms or lamps, as three or five, there are a corresponding number of positions from which the fixture will appear out of balance—*i. e.,* with a preponderance of weight on one side.

FIG. 11.

Theory and Technology

The Photometry of Colored Light Sources

(*Concluded.*)

By S. G. Hibben.

Visual Acuity and Physiological Optics.

We grant that in all practical photometric measurements the human eye is the final judge of the result, and only through this organ can we hope to obtain the knowledge we desire. And we know that the organs of light perception are inherently irregular and uncertain in their action. They differ from time to time and from person to person, and only so far as we can analyze and calculate the errors of visual accuracy, can we hope to be exact in photometrical measurements, be the nicety of the instruments what it may.

It may not be amiss to consider a short résumé of the theory of vision as connected with color perception, and in connection with the above use of types of photometrical apparatus, even though adding nothing new to general knowledge.

It has long since been found by all investigators that the so-called Purkinge effects enter largely into heterochrome photometry, and must be taken into account for accurate work. These effects can be restated in a few words. With a strong value of illumination the red and yellow colors appear brighter than blue or green tints, but with decreasing intensity the latter shades grow brighter and the apparent predominance of the red over the blue is reversed. An example will show this. Pieces of red and blue paper, identical in size and ranging from some 3 ft. square to 1 in. square, were placed in juxtaposition and graded from the large above to the small below—in a vertical plane. These were illuminated by a clear incandescent lamp 10 ft. away. At the start, with normal voltage impressed on the lamp, the red surfaces appeared brighter; furthermore, relative brightness of the red squares increased as the size of the squares decreased. The lamp's voltage was now lowered gradually. The blue squares brighten, and in the large pieces the blue seems to predominate over the red, but in the smaller squares the red still holds its predominance. To the limit of decreased illumination the red becomes black and the blue appears to be a phosphorescent gray. Similar results can be noted in the distance—ratio tests as given above. A certain test of a red to a green lamp showed, with a Lummer-Brodhun screen, an error of 18 per cent. compared with an error of 4 per cent., when comparing similarly colored lights. It is argued that such effects are perceptible at low illuminations only, but in practice the usual colored sources are necessarily of low candlepower, and how much this effect is can be judged from the tests in this discussion.

How may these effects be explained? The most probable and more widely accepted theory is that of the rods and cones. In the retina the optic nerves terminate in rods and cones. These differ in their ability to perceive light in the following manner: The cones are most sensitive to yellow light, while the rods see the light

blue and white colors best. As the intensity of light striking these nerves is increased the rods soon become saturated, so to speak, and see only the general intensity, but not the colors. However, the cones still increase in their perception of yellow shades after the rods have ceased to do so. This would explain the growing predominance of the red colors with growing intensity of light.

Following up the rod and cone theory we can go still further, for here we have an explanation of the so-called "yellow spot" or "Macula-lutea" of the retina, etc. The center of the retina contains cones only and the surrounding portions rods. Hence we would expect the center of the field of vision to be but little affected by Purkinge troubles, and such ideas are born out in practice. Limited time prevented any data being taken on this subject, but it has been noted before that an eccentric view of the field of a photometer is not satisfactory in making a setting. On account of the rods and cones the central part of the retina is less sensitive to the green end of the spectrum than are the surrounding parts. Moreover, no two observers will use the same portion of the retina in making a setting, and the "personal error" is thus partially accounted for. Again, the distance of the eye from the screen would influence the portion of the retina covered by the image and cause differences in readings. These differences, as obtained by merely moving the telescope in and out, have been found to amount to 15 per cent. with a Lummer-Brodhun screen.

The questions of eccentric lights, glare and brilliancy, are all of moment in color photometry. It is a fact that the pupil of the eye is contracted by the light in the total field of vision, while the light for visual perception comes from the center of the field only. Any eccentric lights may cause a diminution in ability to read a setting by as much as 35 per cent. Moreover, the pupil of the eye, like the camera, affords a sharper image when having a smaller opening, yet the excessive glare that causes the smaller opening is to be avoided. Others than the author have found that colors affect the eye in the following manners: Since the illuminating power of blue rays is less than the red rays, all red colors tire the eye more than the others. Unexplained physiological causes are responsible for the fact that the contraction of the pupil is greater for green than for white lights, and also that of the three primary color sensations, green is the most persistent and violet the most transient. Moreover, the rapidity of observation is independent of the nature of the light and also of its intensity.

A fatigued eye will show partiality in different color measurements. The ability to form a judgment of two intensities seems to be partly a matter of practice, for it has been found that after some time spent in the dark room, comparatively good readings could be made of colors as widely at variance as red and green. Now if the observer stopped for an hour or so the readings would afterward settle down to consistent values, but differing by possibly 10 per cent. from those made before. Therefore to the investigators the old question has been recalled: "Is precision due in part to a visual memory?"

Another source of error is that the colors of the lower spectrum (red, yellow, etc.) produce sensations of mere warmth or liveliness, and which are sometimes disposed to be interpreted as "bright." Again, the violet tints produce a pleasantness and restfulness to many people, which influences the readings. By looking into the structure of the eye we can see the reasons for this. The lens of the eye is usually so adjusted as to bring the focus of red and yellow rays on the retina. The natural focus of these rays would fall at some point on or behind the retina, but the focus of violet rays would be shorter and lie in front of the retina. Now the trouble in accommodating for near objects in white or yellow lights will be accentuated for the red end of the spectrum, since the image tends naturally to fall behind the retina. One might say that we are all virtually nearsighted for violet light and farsighted for red colors. Hence the theory that persons having difficulty in judgments of red colors or in reading by yellow lights might find lights of violet tints more restful. Also for distant vision we deduce that red light is most effective and yellow or white less so.

A test was made to investigate distant vision of colored lights such as would be

of interest in railroad signaling. Four 16 candle-power incandescent lamps, of white, signal-green, cobalt-blue and ruby-red, respectively, were suspended outside of the Electrical Building of Case School of Applied Science, Cleveland, Ohio, and elevated where they could readily be seen from quite a distance. Two observers made a series of observations determining the effects of distance upon the appearance of these various colored light-sources. At a distance of about 500 yards the green and blue colors were hard to distinguish one from the other. A thousand yards lends to the green and blue colors almost white tints, which apparently scintillate. Beyond this distance they pale, but the red is still easily distinguishable, as is the white. It was concluded that above 700 yards it would be difficult to distinguish white from green or blue, if not impossible altogether.

How the Flicker Photometer Aids in Color Comparisons.

The claim for the flicker photometer is that it is better in every way for the comparison of lights of different colors. We will find a basis for the fact in the physiological inspection of the eye. Altering the distance of the eye from the screen and the Purkinje effects seem to cause much less trouble in the flicker than in the Lummer-Brodhun instrument. The superiority of the flicker photometer can be traced to the previously expounded "rod and cone" theory. It is known that for ordinary white lights the interval between flickering and continuous sensations varies from one-tenth to one twenty-fourth of a second, according as the light is weak or strong. Therefore, it is suspected that the duration of impressions is different for the rods and for the cones. The quality of flicker at fairly low speeds and low order of illumination is peculiarly violent—quite different from the fine trembling sensations at high illuminations. Again, the fine trembling is best seen directly out of the eye and the violent vibrations seen best from the corners of the eye. Therefore we conclude the fine variety of flicker to be associated with the cones and the violent vibrations with the rods. The cones seem then to be more quick in perceiving vibrations—remembering that they are situated in the center of the retina. A speed of vibration set for one set of nerves would cause the impressions of the other class of nerves to blend. Thus there would be obtained a flicker due to the action of the cones, and superimposed over this a steady luminous impression due to the impulses through the rods—the latter too rapid to give a flickering sensation to the brain. This explains why the struggle between the two sets of organs does not appear so markedly in the flicker screen and why Purkinje effects do not become so troublesome in this type of instrument.

The flicker photometer obviates in a large part those difficulties necessarily attendant upon color comparisons. Though still unsatisfactory, it is the best instrument yet devised for such work, and can be considered much superior to the Lummer-Brodhun type. In fact, any accurate comparisons of widely different colors are hopeless with the latter instrument. Radical claims made for the flicker instrument, to the effect that such a type is not affected by Purkinje troubles, are not substantiated. This instrument proves to be susceptible to Purkinje effects and discrepancies between different observers as do other photometers, but in a less degree. It is doubtful if, when considering the unreliability of the eye, there can ever be devised a practical optical instrument that will be even moderately accurate without account being taken in all measurements of inherent eccentricities of the average eye.

A requirement of color photometry is a very large number of readings, and whenever possible a large number of observers. It can be definitely stated that no two observers will ever exactly agree.

The eye as an optical instrument has been explained, and from a study of it we see the reasons for most phenomena observed. On account of its inherent peculiarities it would always be recommended that a high intensity illumination be used; that the sight fields wall well on the center of the retina; that the distance from eye to screen be maintained constant, and that readings be taken only after some practice and never with fatigued eyes.

(*Concluded on page* 291.)

The Convention

The expected happened. The thirty-fourth annual convention of the National Electric Light Association, which convened in New York this year, surpassed all previous conventions by so great a lead that they might be classed among the "also rans." With a registered attendance of over five thousand, and all meetings and social events proportionately patronized, the convention goes down in history as the leader, and will probably hold this place for some years to come. But this is neither a disparagement of previous conventions nor a reflection upon future events. The association has enormously increased its membership and activities within the past year, and it was to be expected that this would be reflected in the convention. Furthermore, New York City offers inducements possessed by no other city, both in its general attractions and in the opportunity to combine business with pleasure; there are few business men who cannot advantageously transact some business while in New York.

The absence of the commercial exhibits which had become a feature of conventions, was naturally missed, but can perhaps be properly classed among the customs that are more honored in the breach than in the observance. The various electrical shows which are held in different sections of the country are the logical and proper places for the exposition of apparatus and appliances.

The building of the United Engineering Societies offered facilities for the transaction of the business of the association that could not be found in any other building in the United States, and probably not in the world; and it may also be noted that this was the first occasion that the building has had an opportunity of demonstrating the full extent of its usefulness as a meeting place for such occasions. The Hotel Astor was likewise an admirable selection for the scene of the chief social festivities. The building itself has all the necessary equipment and facilities, and the genial manager, Mr. Fred. Muschenheim, is himself one of the electrical engineering fraternity, and the hotel under his care is one of the first and best examples of the value of practical illuminating engineering. It is interesting to note that the results of the engineering, in which Mr. Muschenheim had the cooperation of some of the first illuminating engineers, were so successful that the generating plant has been found sufficient for the present building which is double the size of the original structure.

As there is said to be no great loss without some small gain, so there is no great gain without some small loss. The enormous increase in numbers reduced somewhat the family feeling that pervaded the smaller gatherings. Among five thousand gathered from the four quarters of the country there must necessarily be a great majority who are strangers to one another, and a week is too short a time to make any great inroads upon this lack of acquaintance.

The fact is that the association has outgrown its former habits and customs, as the present day university has outgrown the old time college. This difference is shown in the character of the proceedings as well as in the social events. The important parts of the program were not

papers of personal authorship, but reports of standing committees; and a committee, like a corporation, is bereft of soul: a committee report is necessarily an impersonality. However, the change is the result of new conditions, and the new order must be accepted and utilized to the fullest possible extent. The report of a committee that has been judiciously chosen, and has given conscientious work to the purpose for which it was appointed, will generally be a more important document than a paper by a single author: it most assuredly will if the paper is written with an eye to exploiting the writer, or by an author appointed by courtesy but whose available time for outside work is too limited to permit of the necessary efforts to bring out matter of new or lasting value. On the other hand, a committee, the personnel of which has been made upon "political" considerations, and whose report is a mere collation of previous writings and generally known facts properly trimmed to avoid treading on anyone's favorite corns, may be even more colorless and valueless.

Of the two evils there is little to choose between perfunctory individual papers and perfunctory committee reports. An individual may be readily forgiven for the display of a certain amount of personal enthusiasm or prejudice. Original creations and positive convictions are seldom entirely free from these trifling blemishes; but it is one of the chief objects in the collective work of a committee to eliminate the unknown factor of the personal equation. The object of a committee is to get at "the very truth of the matter," not to make out a case; it is a jury rather than an advocate.

The committee reports presented are fairly free from the general criticisms made, although there are some evidences of hasty work. For this the committees in this instance should be held blameless. Anyone whose ability is of sufficient value to render him available for special committees is necessarily busily engaged in his every day affairs, and he should not be expected to give any considerable portion of his valuable time to work for the general good. In order that committee work be valuable it must necessarily have paid labor. If the committee members themselves give the benefit of their experience and knowledge in the general direction of the work they have done their full duty. The details of investigation, collection and collation of facts are matters for regularly paid service. The work of the N. E. L. A. is in a transitional state in this regard, and judging by the thorough manner in which it has performed its various functions and met conditions as they arose, it is safe to say that the plan of working through committees rather than individuals will be brought to the highest state of efficiency as soon as the new order is thoroughly established. This method of work is unquestionably the better method for an association of the size and importance of the N. E. L. A. Personal papers are not thereby ruled out, but shifted to the sectional meetings, where their full value can be retained for the association at large.

Competitive Illuminants

When a man begins to talk about the merits and demerits of his competitors' goods he is treading on treacherous ground. If he is imbued with the proper spirit of enthusiasm for his own products his opinions, no matter how conscientiously he may form them, will be colored by his personal preference; if he attempts to discount this preference he is more than apt to betray his own case, and if he gives full rein to his enthusiasm he will underestimate his competitors' worth.

The report of the Committee on Competitive Illuminants must, therefore, be considered by the disinterested reader in the light of these difficulties. It would be utterly impossible for a committee to give any report on this subject that would not be open to the attacks of those interested in the competing illuminants. There are always two sides to a story, and giving one side, either correctly or incorrectly, furnishes the best possible basis for the arguments of the other side. Not even the most optimistic salesman will seriously claim perfection for his wares, and in the absence of perfection there are points of criticism and an opportunity for competing wares to offset the advantages by showing that they are strong where the other is weak. With all the multiplicity

of light-sources and apparatus at present available no sane man would claim that any one of them was superior in all points to all the others. If this were the case the one superior source or unit would speedily put the others out of commission and occupy the field alone. Each different source or unit has its advantages and disadvantages; the former give it the preference under certain conditions, while the latter rule it out under others. Even that most ancient and inefficient of light-sources, the candle, is still largely used, and for no other reason than because it is actually the best under the circumstances. So also the common gas flame can hold its own against all competitors to a certain extent, not even the mantle gas burner excepted.

Laboratory Tests Not Conclusive.

A general comparison of different light-sources by laboratory tests manifestly has some value, but it is as far from being conclusive as a written examination is of determining what individual will be most successful in life. The confirmed dullard in school has time and again far outstripped the honor class in the real affairs of life; and the light-source that shows the most brilliant record in the laboratory may be the most dismal failure in the hands of a careless user, or when installed in an unfavorable location. The relative efficiency of different illuminants under the best possible conditions is a matter that can be readily determined and established beyond dispute, but their practical value will depend very largely upon the manner of their use. Some one has said that the best religion is the one that is best lived up to; and it could be said with perhaps an equal amount of truth that the best light-unit is the one that is best taken care of.

In making tests of units under working conditions there is opportunity for enormous discrepancies and errors which can be reduced only by testing a great number of cases. The difference in the performance of an individual unit in actual use may vary anywhere between zero and 100 per cent., and it is a simple matter to make out a case against any unit by selecting an installation in which conditions were either unfavorable or in which it was not given decent care.

From the commercial standpoint it is a serious fallacy to underrate or belittle a competitor, either intentionally or unconsciously, and misstatement of facts by either exaggeration or depreciation is still more dangerous, it gives the competitor an opportunity to impeach the whole testimony.

Some Questionable Statements Regarding Gas.

Unfortunately, some misstatements in regard to gas crept into the report of the Committee on Competitive Illuminants. For example, the following statement:

"The upright mantle burner is simple in construction, and has a comparatively high efficiency of light production. Its inefficiency as a luminant is due to the fact that most of its light is emitted near the horizontal and cannot be easily redirected."

The distribution of the upright mantle burner is practically identical with that of an incandescent electric lamp, and there is no more difficulty in efficiently redirecting the light of the former than the latter.

"The inverted burner is considerably more complicated than the upright, but has the advantage that it directs more of the light where it is needed."

The inverted burner is mechanically no more complicated, and is simpler for the user, especially with regard to replacing mantles.

"The superiority of the inverted burner equipped with prismatic reflector is evident. However, this lamp may be had in only one side, and where a wide distribution of light is desired a diffusing globe must be substituted for the prismatic reflector."

A foot-note in the report indicates that this is taken from an article published in 1909. At the present time three different sizes of individual inverted burners are to be had; and where a wide distribution is desired from any light-source it must either be used bare or with a diffusing globe.

"The choice of reflectors is small (in the case of cluster gas diffusing globes only can be had), and hence with these lamps general distribution only can be obtained, the result of which is a large loss of illumination on side walls."

Every type of reflector available for incandescent electric lamps is also available

for the inverted mantle burner. The choice of reflectors for either is necessarily limited, because there are only a few types to be had. As to cluster gas it competes with the electric arc, as is shown by the name by which it is commonly known, "Gas Arc," and is less limited in its use of globes and reflectors than its electric counterpart.

"To operate satisfactorily the lamps should be given regular expert attendance as often as once a week."

A good mantle burner equipped with a high grade mantle will run from six months to a year on ordinary service without attention, and there are some forms of electric lamps which require regular expert attention daily.

"Gas lamps vitiate the atmosphere to such an extent that in making calculations of the ventilation required factory inspectors rate one gas burner as the equivalent of from four to five men."

It has been proven by the most exhaustive, impartial investigations that gas lamps do not render the air less fitted for breathing purposes. In fact, if anything they tend to improve it by increased ventilation and partial sterilization.

"The 'white light' mantle is almost never used because of the low efficiency and short life."

There are hardly any other mantles used other than "white light" mantles, all of the cheaper grades being distinctly of this class.

"It is not unusual to find a variation of as much as from 1 to 6 in. on the consumers' lamps during twenty-four hours."

Gas pressure varying this much at any one point is certainly unusual, at least as unusual as voltage variations of 20 per cent., which is well nigh destructive to most forms of electric lamps.

We have quoted only such statements as can be flatly contradicted, and must therefore be set down as errors in fact. We hold no brief for gas as an illuminant, and therefore have no occasion to enter into simple argument, but may mention in passing that the advocate of gas has plenty of opportunity to put in rebuttal argument before the case goes to the jury.

Where the Gas Interests Are at Fault.

It is usually considered a strategic advantage to place a competitor on the defensive; this is subject to qualification. If the indictments cannot be sustained the defense may react, not only in clearing the charges, but in implicating the plaintiff in false accusations. Gas light has for some time been on the defensive in this country, and, in fact, the case has gone by default so long that its competitors have naturally become more aggressive. Furthermore, a number of the most serious allegations made against gas lighting are substantially true, and for no other reason than shortsighted and ill-considered policies on the part of the gas lighting interests themselves. For example, incandescent electric lamps, which are the principal type to compete with gas, have long been thoroughly standardized and brought up to the highest possible pitch of uniform quality, so that it is practically impossible for either a consumer or a central station to purchase an inferior lamp. The incandescent mantle, however, which has been the salvation of gas lighting, has been turned out and sold without the slightest attempts at standardization or at educating the consumers as to differences in quality. Even the gas companies themselves, generally speaking, will let a difference of a cent in cost of mantles determine their choice rather than difference of 100 per cent. in quality. The enormous discrepancy between laboratory and working conditions of mantle gas lamps is thus easily accounted for. If the gas companies themselves will not protect the reputation of their product and the interests of their customers, it is small wonder that the electric people have taken full advantage of this weakness.

We have always maintained that a lively competition between all forms of illuminants and illuminating apparatus was the surest method of realizing the greatest possibilities in lighting, both for buyer and seller.

This report should have a wholesome effect in stimulating the gas interests to supply a standard of excellence—and that the highest—in all the apparatus which they use or sell, whether it be lamps, man-

tels, fixtures or accessories. The only substantial refutation of the charges made against gas will be by *doing* rather than by mere arguing.

Industrial Lighting

The report of the committee on this subject contains much valuable matter, although the subject is so large and involved that any comprehensive treatment of it must necessarily occupy a volume rather than the space of a convention paper. The treatment of the generalities of the case is "safe and sane," and the detailed accounts of particular installations affords valuable data for practicing illuminating engineers.

There is probably no problem in illumination in which there is so much need of extended investigation as in industrial lighting. We know many of the things to avoid, but as to what is actually best under given conditions few unbiased scientists would care to give an opinion at the present time.

The National Association of Manufacturers has been investigating the same subject, and has issued a brief report giving a summary of their investigations to date, which includes a review of two hundred and fifty answers to questionaires sent out to various factories. One reply stated that "while the conditions of artificial lighting in the factory in question were ideal, the output under artificial light would average 20 per cent less than under daylight." This may conform to an ideal, but certainly the ideal is not a high one, and is a most significant indication of the extent to which poor lighting is accepted as a matter of course. Certain very large factories, to our personal knowledge, have positively stated that their output, both in quality and quantity, of the night turn is absoluely the same as that of the day turn, and in these particular cases the work is such as to require particularly accurate and quick vision.

The work of this committee is highly important, if for no other reason than that it calls the attention of manufacturers to the importance of the subject. Mr. William Coale is chairman of the Lighting Committee.

A committee of the American Medical Association, headed by Dr. William Campbell Posey of Philadelphia, has also undertaken an investigation of industrial lighting, and the Industrial Department of the American Association for the Conservation of Vision will inaugurate a comprehensive study of the subject at the beginning of the lighting season this Fall, so that it may be reasonably hoped that reliable and definite rules of practice may be determined within the near future.

Decorative Street Lighting

The report of the committee on this subject contained a collection of valuable data regarding the details of installations in different cities and towns and some general observations on the subject. The discussion of the report brought out more live issues in regard to the subject than the report itself. Chief of these was the question of efficiency of illumination vs. decorative features. One speaker called attention to the fact that by the use of certain reflectors the intensity of illumination on pavements could be increased more than one-third over that secured by the ordinary diffusing blow.

This brought out a rather vigorous protest that decorative street lighting was for decorative purposes, and that efficiency had no place, at least in comparison with appearances. Another speaker went still further and said that the only interest that central stations have in decorative street lighting is to sell current and that they are therefore not interested in either efficiency or appearances, but only to get up the lamps. To the credit of the association, this latter policy was disclaimed by another central station manager. He declared that the effect of good public lighting in securing public good will was at least as important as the mere sale of the current.

Decorative street lighting that is not decorative is certainly a case of acting Hamlet with Hamlet left out, but the last two words of the phrase must not be forgotten either. A system that did not light the streets would be like omitting the play altogether. It is simply one phase of the old argument of utility vs. decoration; the two are by no means incompatible. If a device can be found which is at once

equally decorative and more efficient there is no possible excuse for not using it, even though it be made by " a particular manufacturer," for after all, what is the central station but a particular manufacturer of electric current? It does not follow that that which is ugly is useful, nor that which is beautiful is useless, or even inefficient. The real test of the value of a decorative street lighting system is the extent to which it combines good lighting with good art; and the same holds true of any interior installation in which art is a factor. The policy of putting up anything that will bring in returns needs little argument; it is an echo of the old " people-be-damned " policy, which has happily fallen into " innocuous desuetude." A central station is above all other enterprises a permanent institution, and therefore has more than ordinary reasons for taking the long-sighted business view; and a lighting installation put up in a spasm of public acclaim and repudiated the next month or next year is a poor piece of business. It may be " commercialism," but of the kind that is rightly deplored.

Public lighting affords one of the most valuable means by which a central station can bring itself favorably before the public, and it should use this opportunity with all possible discretion and good faith.

The Relative Value of Different Forms of Public Illumination

Under the above title Mr. H. N. McConnell, Manager of the Commercial Department of the Susquehanna Railway, Light & Power Company, contributes a short but highly interesting article, which appears elsewhere in this issue. So much has been said concerning the value of the new decorative or spectacular street lighting that it has come to be generally accepted as the unquestioned essential in the use of electric light for municipal and private publicity.

So far as the merchant is concerned, however, there are two other methods of using electric light which must by no means be neglected, viz., for the illumination of show windows and for use in electric signs. So important in fact are these two methods of luminous publicity that the question is justly raised as to which stands first. From the merchant's viewpoint the all-important thing is for people to look at the wares displayed in his show windows, and it is natural therefore that he should give show window lighting first importance. This argument, however, is not final. The ultimate object of the merchant is that people should purchase his goods, but before they can purchase they must enter his store and examine his wares and prices. Unless they do this there will be no purchasers. Since it is the practice at present—a very ill-considered one, as we believe—of keeping stores closed in the evening, the most the merchant can expect is that people will look at whatever wares he may display in his windows. But in order to do this the people must first come out into the streets and pass his store. Unless they do this the most beautifully lighted windows in the world would be of no value.

The question of first importance is, therefore, how to get the people on to the streets at night. For this purpose the lighted show window can hardly take first rank. We can scarcely conceive of crowds of people thronging a street simply to look into the windows. It is here that decorative street lighting serves its chief purpose from the merchant's standpoint, with the electric sign a very close second.

The besetting sin of the American is his tendency to carry everything, good or bad, to an excess. Light is a good thing to have in a street at night. Therefore let us have a deluge of it—more than any one else has. This has been the motive in a number of cases. The flaming arc is a giant in light production, and yet so-called decorative lighting systems have been put in with two of these monsters to each post, and distributed in the manner of the old comparatively feeble carbon arc. With such a conflagration of light there could, of course, be no competition; signs and show windows would be wholly eclipsed. but this does not prove that the flaming arc is a bad thing for street lighting, or that ample illumination is a menace to other forms of luminous publicity when properly used.

It is not so much a question of which is the best, as how to use all three in their proper places and degree. A judiciously arranged installation of decorative street

lighting unquestionably promotes the use of the streets by night. The electric sign used with similar discretion and taste adds largely to this result, and both make it worth while for the merchant to decorate and illuminate his windows with the utmost skill.

Editor Illuminating Engineer:

The editorial on page 169 of your May issue seems to be based on curious conceptions of my article in the *Electrical World* of March 30, as I cannot find some statements attributed to me. For instance, you quote me as telling "why indirect lighting can *never* be successfully accomplished by gas." What I did was to quote the reasons why indirect lighting equipment when tried with gas by a certain manufacturer had not proved a success and why this indirect lighting, though quite practical with tungsten lamps, was *at present* out of the question with gas. I have much too strong a faith in the possibilities of gas lighting, with proper engineering talent applied to the same, to believe that the shortcomings to which I alluded as existing at present will continue forever.

As to the use of an enameled ceiling plate over gas lamps to facilitate the cleaning of the ceiling, as is now done in the People's Gas Building at Chicago, that might be ideal if the dust carried up by the air currents kept within the confines of these plates. Failing to do so, each plate when wiped clean shows a dark fringe surrounding it on the ceiling, much akin to the high-water mark on the neck of a boy who has hastily washed himself—hardly an artistic effect.

As for the use of silvered glass reflectors with gas for indirect lighting, that may indeed be possible; all I reported was its having failed in practical trials, which means that the problem is not as simple as might have been supposed.

Regarding pilot flames I do not know whether the meter in Mr. Macbeth's house was not sensitive enough properly to record the small consumption or whether he really gets along with a smaller amount of pilot gas than is common at Chicago. Here, Mr. Luther has been devising new pilot burners for reducing the amount of gas thus used, which he reports as usually from ¼ to ½ cu. ft. per hour—15 to 30 cents a month at the Chicago gas rate of 85 cents. In what proportion of cases even the 30 cents do not cover the consumption, would be interesting to know, but this, as well as other features of the present gas practice, may see improvement during the years to come. Indeed, if all of the shortcomings which the electric light solicitor may find in gas light practice at present can be overcome, so much the better for lighting practice in general.

Albert Scheible.

Editor, The Illuminating Engineer:

Several years ago, I was led to feel, due to certain observations and experiments, that for certain types of installations delicately tinted illumination was desirable, which thought gave rise to further considerations all of which have substantiated my original appreciation of such color treatment. Two or three years ago, I contributed a short article to the technical press suggesting that concerns having to do with the manufacture of incandescent electric and gas lamps, and accessories, employ means to introduce these yellow values in effects produced from such paraphernalia, suggesting that in the case of the electric incandescent lamps that the glass bulbs could be of delicately tinted yellow; in the case of the gas incandescent lamps certain chemicals can be used in the preparation going to form the structure of its mantle which would give the desired amber, india or yellow tinted tone, or that the glassware employed be such that through which, when the light rays had filtered, would give rise to such effect.

I have, from time to time, attempted to interest the manufacturers in the public's appreciation of the "warmth" in illumination, endeavoring to show that this "warmth" was so highly prized by the lovers of the artistic, and likewise by the executive of the household—the wife. With the increased efficiency of incandescent lamps, which have a tendency to produce "cold," "hard," "garish" effects the necessity for softening is the more evident, and ere long I feel that a demand will be made by the public for such effect. A manufacturer who anticipates this demand, and establishes the means of sat-

isfying it, will undoubtedly reap a harvest.

A very interesting article entitled "The Effect of Yellow Glass on the Efficiency of Incandescent Lamps," by Dr. Herbert E. Ives, appearing in the April issue (1911) of your magazine very intelligently sets forth the physicist's side of this problem, it being shown that the treatment of incandescent lamps, to give rise to such effect, would not materially decrease the efficiency. This article, for the most part, treats with the physical efficiencies involved. If we consider the physiological phase of the matter, it will be found that inasmuch as the eye is the more susceptible to yellow than any other rays, that the visualizing efficiencies of such illumination would, in all probability, be increased.

There appears in the April 15th issue of the *Scientific American* a most interesting article by Louis C. Tiffany, entitled "The Tasteful Use of Light" or "Color in Artificial Illumination," wherein, in part, Mr. Tiffany writes as follows:

"It is proverbial that 'colors seen by candle-light do not look the same by day,' and the question at once arises whether or not it would be desirable to have our illumination at night exactly the same as by day. The primitive means of lighting by burning wood, by candles and then in later times by gas, all give a light which is yellowish and quite different in character from sunlight and mankind has from time immemorial expected that this artificial light at night would be yellowish and different from sunlight, and has made everything to be seen at night of such quality and texture and color that it would be seen to the best advantage by a slightly yellowish light. Whether or not it would be possible even if it were preferable to change all this by a system of lighting which would be identical with daylight, must remain for the present an open question. Our hereditary need is for an artificial light which shall be slightly yellow. Yellow is the color of brightness and mirth. Through hereditary association of ideas yellow suggests to the mind the idea of brightness, brilliancy or sunshine, while blue suggests cold, and by suggestion gives one the sensation of cold, while red on the contrary gives in the same way a sensation of warmth. A room lighted with reddish light gives distinctly the sensation of warmth, while a bluish illumination gives with equal distinctness the feeling of cold. Of two exactly similar rooms, one of which is lighted with blue and green lights and the other with red and yellow lights, every one will involuntarily select the warm light in a cool climate or the blue room in a warm climate."

Mr. Tiffany, as an artist, evidently appreciates the value of the yellow tinted light.

Aside from the phases already briefly touched on, there is another and that the psychological influence of properly tinted yellow light on the mind. If we take a room, such as may be used for living purposes in the home, and illuminate this room by properly placed illuminants, giving rise to this warm color value, it has a most beneficial effect in inducing relaxation—a Godsend to the tired, whereas if the room is illuminated by a "colder," "harder," illumination, there is a decided tendency for the muscles and nervous system of the body to "tighten."

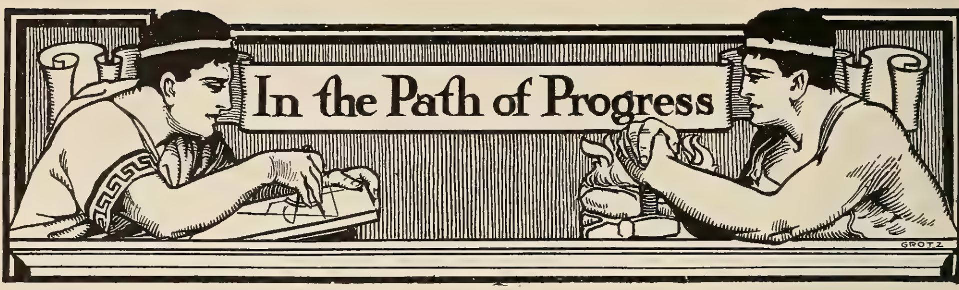
The question of color in illumination is a most important one and should receive very much more consideration than is usually the case—ofttimes becoming more important than foot-candle intensities.

Very respectfully yours,
ALBERT JACKSON MARSHALL.

"The Photometry of Colored Light Sources" (Concluded)

(*Continued from page* 283.)

Finally the growing importance of illuminating engineering and its accompanying demand for careful study of the physiology of artificial lighting makes necessary the detailed study of heterochrome photometry in all its aspects. Physical health and comfort of the race lies in the hands of the engineers who design illuminating systems, to say nothing of esthetic satisfaction, economy of lighting energy, and general efficiency. All these factors argue in favor of a complete knowledge of the photometry of colored light-sources, and it is to be hoped that the individuals augmenting the ranks of illuminating engineers look well into the not-too-theoretical investigation of commercial laboratory color measurements.



The Drawn Wire Mazda Tungsten Lamp

The General Electric Company, Schenectady, N. Y., and the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, have issued bulletins giving data and information concerning this latest development of the tungsten lamp, which they are now prepared to furnish regularly for multiple circuits for voltages from 100 to 250 and in sizes from 25 to 500 watts.

The production of drawn wire from a metal which had been positively classed as brittle and non-ductile is a distinct victory of modern scientific methods, and the completeness of the victory may be best appreciated by the statement that not only is the metal now drawn into wire, but of a wire one thousandth of an inch in diameter and in commercial quantities. This achievement is not only the latest word in filament electric lamps, but is probably the final word. The improvement is comparable and perhaps parallel with the production of the squirted cellulose filament in place of the paper or silk thread filaments which were first used.

The variation in texture and size of drawn wire is the minimum attainable by human means, and hence the uniformity of the product should be all but absolutely perfect. The use of drawn wire also permits of several improvements in mechanical construction, such as the looping of the wire on the reel and the consequent use of a filament of one piece, although it must here be remarked that this construction has been followed for some time by one of the large manufacturers using a filament prepared without drawing.

Now that tungsten has been successfully drawn into wire, it possesses but one objectionable feature as a filament material, viz., its comparatively low resistance, which necessitates the drawing of extremely fine wire and the use of a considerable length. Both of these obstacles, however, have been reduced to a minimum, and the tungsten lamp will unquestionably take the center of the stage in incandescent electric lighting for some time to come. From present knowledge of elements for filament material it would seem that tungsten could not be improved upon, but the production of ductile tungsten from a metal supposed to be inherently brittle comes so near to realizing the old dream of the alchemist of the transmutation of metals that one hesitates to make predictions; so that it is perhaps the part of discretion to simply state that the drawn wire tungsten lamp marks another stage in the progress of electric lighting.

The Practical Operation of Arc Lamps

Under this title the National Carbon Company, Cleveland, Ohio, has issued a neat and convenient little booklet of pocket size, which contains plain and explicit directions for the care of different kinds of arc lamps, together with additional tables of value to electrical illuminating engineers and wiremen.

National Electrical Contractors' Association Convention

The eleventh annual convention of the National Electrical Contractors' Association will be held at Niagara Falls, July 19 to 21. An interesting programme of open addresses, executive sessions and social events has been prepared. In view of the fact that this association has prac-

tically doubled its membership within the past year, and that Niagara Falls offers unusual scenic attractions as well as opportunities for witnessing some of the greatest electrical generating plants in the world, the convention will undoubtedly be a record breaker.

Illuminating Engineering Society Convention

The fifth annual convention of the Illuminating Engineering Society will be held in Chicago, September 25, 26 and 27. The programme is not yet sufficiently matured for publication, but the fact that three days are set aside for the sessions is evidence that an extended series of papers and subjects will be presented. As this is the first time that the convention has been held away from the Atlantic seaboard, it will give an opportunity for the numerous Western members to attend, so that it is safe to predict that the attendance will be large and enthusiastic, while the well-known hospitality of Chicago gives full assurance of an attractive programme of social events.

Acetylene Convention

The annual convention of the International Acetylene Association will be held at Atlantic City, July 25, 26 and 27. Headquarters will be at the Hotel Shelburne. The usual strong programme of papers has been prepared, and the social events will be fitting to the facilities and renown of this seaside convention resort.

Minneapolis Electric Show

If " well begun is half done " the third annual electric show to be held in Minneapolis next March is at least half done, as a most excellent beginning has been made even at this early date. The central stations throughout the Northwest are giving extensive co-operation, while the Commercial Club, which is so largely responsible for the magnificent decorative lighting of the city, is giving both its moral and financial support. Equally significant is the fact that the Minnesota Electrical Association, and the American Institute of Electrical Engineers are to hold meetings in the city during the show.

The multiplication of electrical shows throughout the country is a most fortunate and laudable movement. They are undoubtedly powerful factors in public education along practical lines, and will do much to give the people a sane and reasonable view of this greatest of public utilities. May their tribe increase!

Personal

Mr. G. H. Stickney, who has become well known in the electric lighting field as the active and progressive assistant to Mr. W. D'A. Ryan, Illuminating Engineer of the General Electric Company, Schenectady, N. Y., has recently been transferred to the Incandescent Lamp Department, in which he will have charge of illuminating engineering, under the title of Assistant to the Manager of Incandescent Lamp Sales. His intimate practical and theoretical knowledge of illuminating engineering work, especially in the line of photometry, fits him for the work in his new position, in which he will bring the selling force into closer relations with the illuminating engineering end of the business.

Mr. Stickney is a graduate of Cornell University, from which he entered the instruction class of the General Electric Company at Lynn, Mass. Improvements which he suggested in the photometric work while in this class resulted in his being made an assistant to Mr. Ryan in this department. He has made a host of friends by his genial manner and frank and square methods of dealing, and will have numerous well-wishers for the continuance of his past success in his new work.

Proceedings of Technical Societies

PROCEEDINGS

DISCUSSION

Illuminating Engineering Society

At the meeting of the New York Section two papers were presented by Sydney W. Ashe: "A Corporation Graduate Course in Illuminating Engineering" and "A Comparison of Various Illuminants."

The first paper dealt with the course in illuminating engineering given by the General Electrical Company, at Harrison, N. J., to a number of college graduates who had entered the service of the company. The course was intended to be comprehensive and complete, embodying lectures, instructions and practical work. The lectures were given by college professors and technical experts in the various subjects which included every phase of the field. The course was still in progress at the time the paper was read, and the results were said to be highly satisfactory to the men of the corporation.

The paper on the comparison of various illuminants was largely devoted to a discussion of the average light production of the different illuminants under actual working conditions. As is in all cases where figures on costs or performances were given the paper created a lively discussion, those interested in the different illuminants each having some points of objection or criticism to the figures given. Further comment on this paper is given in the editorial department.

The following officers were elected: Chairman, Bassett Jones, Jr.; secretary, Albert J. Marshall; managers, H. Thurston Owens and Dr. Seabrooke.

At the Chicago section a paper was presented by W. B. Bradley on "Natural Daylight Illumination." The paper was devoted to a recital of the advantages of prism glass in increasing interior illumination by daylight.

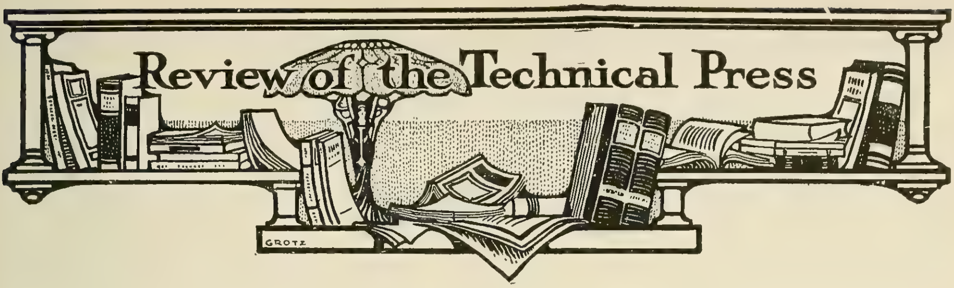
The following officers were elected for the ensuing year: Chairman, R. F. Schuchardt; secretary, A. L. Eustace; managers, Charles L. Luther and A. J. Morgan.

The Philadelphia section held its regular monthly meeting on the evening of June 16. Two papers were presented: "Filament Ignition of Gas," by Howard Lyon, and "The Lighting of a Garage," by R. N. Zeek.

Mr. Lyon explained the phenomena of gas ignition by catalytic action of the platinum group of metals, and gave an interesting description of the obstacles to be overcome and the methods used for securing a practical working device for igniting gas lamps. By this method a filament of platinum alloy is used which is heated to dull redness by the current from a dry battery. This heating starts the catalytic action which causes the temperature to increase to the kindling point. The battery is placed within the fixture so that the whole is self-contained. Pulling a chain turns on the gas and electric current, producing ignition. When the chain is released the current is switched off. The next pull of the chain turns off the gas. The device has been given practical tests and appears to be sufficiently reliable to be commercially practical.

Mr. Zeek gave a detailed description of the lighting of a garage by the use of Mazda lamps and Holophane reflectors, the building being 30 x 75, two stories in height.

Previous to the reading of the papers, the annual election took place, the following officers being chosen: Chairman, Joseph D. Israel; secretary, L. B. Eichengreen; managers, C. W. Wardell and Prof. A. J. Howland.



American Items

General Illumination of Manhattan Borough and Description of Electric Signs; *Electrical World*, May 25.

An article on street and sign lighting in the Borough of Manhattan fully illustrated.

Stone Lamp Posts in Bloomington, Ind.; *Electrical World*, May 25.

Concrete Tungsten Lamp Posts; *Electrical World*, May 25.

Experience With Concrete Poles in Oklahoma City; *Electrical World*, May 25.

White Way Lighting, Using Side Walk Gallery Supports in Southern City; *Electrical World*, May 25.

Ornamental Street Lighting With 250-Watt Tungstens; *Electrical World*, May 25.

Village Street Lighting; *Electrical World*, May 25.

Simple Method for Calculating Illumination, by James R. Cravath; *Electrical World*, May 25.

The writer refers to the fact that it has been customary to figure the number of units required from certain tables of factors giving the overall efficiency of the units for different classes of illumination, but states that this may lead to error if the measured efficiency of the lamps should be varied. He therefore suggests that the useful efficiency of the units expressed in watts per lumen be used as an additional factor. The method of procedure would then be as follows:

"The method of procedure is as follows: After deciding upon the average foot candles illumination on the working plane which in the judgment of the designer is necessary for the installation under consideration, apply the following rule: Multiply the average foot candles by the square feet, and divide this product by the efficiency constant for the given conditions. The result will be the total number of lumens which the lamp must generate. Tungsten lamps are now rated in the manufacturers' table, according to the lumens they produce, and the same will doubtless soon be true of other lamps. The engineer then selects lamps of a sufficient number and size to generate the lumens necessary for the installation. The lumens generated by any lamp can be determined by multiplying the mean spherical candle-power by 12.57."

The Tungsten Versus Flaming Arc Lamp, by J. Gustaf B. Lang; *Electrical World*, May 25.

A letter to the editor in which the writer takes some exceptions to the figures given by Mr. Magdsick printed in a previous issue. Mr. Lang claims that at a four-cent rate for current the flaming arc will show a 7½ per cent. saving over the tungsten cluster, and gives figures to substantiate his claim. He also asks why the long burning flaming arc may not be properly considered, which, according to his figures, shows a saving of 27 per cent. over the tungsten cluster at a two-cent rate for current, and 31 per cent. at a three-cent rate.

Cost of Magnetite Arc Lighting in Worcester; *Electrical World*, June 1.

An article giving facts and figures pre-

sented in the hearing of the Worcester (Mass.) Electric Light Company before the State Gas and Electric Light Commission. The company claims that the cost per lamp of running the installation of magnetite arcs is $96.28 a year. At a former hearing the commission had produced figures to show that the cost should be about $65 per lamp.

ADEQUATE ILLUMINATION FROM THE CIVIC STANDPOINT; *Electrical World,* June 1.

STREET LIGHTING IN PUEBLA, MEXICO, by Roscoe Scott; *Electrical World,* June 1.

LIFE OF SERIES TUNGSTEN LAMPS AT CEDAR FALLS, IOWA; *Electrical World,* June 1.

UNIT LIGHTING IN A SMALL OFFICE; *Electrical World,* June 8.

INDIRECT LIGHTING VERSUS GAS, by Albert Scheible; *Electrical World,* June 8.

A short letter in answer to a letter by Mr. Norman Macbeth. Among other things the writer states that he wrote of conditions as they existed and not as they may be, and that he personally believes the time will come when indirect lighting fixtures may be adapted to gas.

VISUAL ACUITY, by Sidney W. Ashe; *Electrical World,* June 8.

LUMINOUS EFFICIENCY, by Herbert E. Ives; *Electrical World,* June 15.

The writer states that the article is both an addition and a correction to his paper presented before the Illuminating Engineering Society on the same subject. The corrections are simply those resulting from later investigations. The writer claims that the only measure of luminous efficiency that is practical is in lumens per watt. The question is discussed mathematically, and a page of data on arc lamps is given.

CHROMATIC ABERRATION AND VISUAL ACUITY, by Dr. Louis Bell; *Electrical World,* June 15.

A letter to the editor answering some comments by Mr. Ashe on the writer's article on the subject in a previous issue. That the greater visual acuity resulting from monochromatic light is not due to pupillary construction as Mr. Ashe had claimed, but what the writer states is shown by the fact that the phenomena remains the same in his experiments when using a diaphragm less in diameter than the pupil. His conclusion is interesting.

"The long and short of the matter is that the eye seems in the course of its evolution to have adjusted its pupillary mechanism to the luminosity value of the stimulus, while in respect to defining power it behaves like any other unachromatized optical system, gaining greatly by monochromatic illumination and to a minor extent, inversely as the wave lengths of the lights concerned, by a change in the effective color of the stimulus."

PHOTOMETRY AND PHOTOGRAPHY, by James R. Parton; *Electrical World,* June 15.

TEST OF GASOLENE STREET LAMPS, by James R. Cravath; *Electrical World,* June 22.

A letter to the editor in which the writer explains a method by which the tests of gasolene lamps were made for the Merriam commission in Chicago. The method of selecting the lamps to be tested was one to absolutely ward off partiality either for or against the lamps. The first series of tests showed that the lamps averaged 19.4 horizontal candle-power, while a second set of tests showed 26.4. As a result of these tests the new contract with the company supplying them provided for a series of rebates when the average of 150 lamps tested each month was found to run below 45 candle-power, the rebate running from 5 per cent. for 40 candle-power to 100 per cent. at 15 candle-power, or below.

THE TUNGSTEN VERSUS FLAMING ARC LAMP, by H. G. Magdsick; *Electrical World,* June 22.

A letter to the editor replying to Mr. Lang's letter previously mentioned. The writer points out that 4 per cent in an industrial plant is an unusually high rate for electric current, and that 1,700 hours is the rated life of tungsten lamps on low efficiency, which is the ordinary industrial condition of operation. He admits that the 150 hour flaming arc lamp, if successful, will be a very valuable unit, and that

with present lamps the tungsten cluster will successfully compete.

Discoloration of Metal Lamps; *Electrical Review and Western Electrician,* May 27.

Street Lighting Equipment in New York City, by H. Thurston Owens; *Electrical Review and Western Electrician,* May 27.

An article fully illustrated covering the different types of street lighting fixture used throughout the city.

Gas and Electric Street Lighting, by "Engineer"; *Electrical Review and Western Electrician,* May 27.

A letter to the editor in which the writer rather vigorously protests against what he calls "mud-slinging" against street lighting with gas. He states that under ordinary pressure a 5-mantle lamp will give 600 actual mean lower hemispherical candle-power with 15 cubic feet of gas per hour, and under high pressure three mantles will supply 4,500 m. l. c.-p. with 85 feet of gas. He refers to the recent supplanting of electric lighting by gas in the Westminster (London) district, and says that the statement that even in England gas lamps are being steadily crowded out is not according to statistics.

Ornamental Lighting at Reading, Pa.; *Electrical Review and Western Electrician,* June 3.

Units for Street Lighting; *Electrical Review and Western Electrician,* June 10.

Gas and Electric Street Lighting, by Albert Scheible; *Electrical Review and Western Electrician,* June 10.

A letter to the editor answering the letter of "Engineer" in a previous issue, as above noted, in which the writer makes a number of points against gas lighting, and states that the replacement of electric arcs in London was accomplished by a cut of 40 per cent. in the price of gas, but while only sixty-six electric arcs were replaced, 1,300 new electric arcs were installed during the year.

Lessons from the People's Gas Building, Chicago, by Albert Scheible; *Electrical Review and Western Electrician,* June 17.

A tersely written review of the gas lighting installation in this building with special reference to a paper on the same subject presented by Mr. Luther before the Illuminating Engineering Society. The entire article is written from a distinctly electrical viewpoint, and while the various points of success are freely acknowledged, arguments are produced to make out a case for the superiority of electric light. The headings of the various paragraphs are as follows:

Adapting gas to modern buildings requires radical changes;

Gas fixtures can be thoroughly artistic;

Fixtures should harmonize with their surroundings;

Economy of heavy glass globes;

Single-lamp units superior to clusters;

Boosting the gas pressure makes it more efficient;

High-pressure gas mantles must be lighted slowly;

Non-electric gas switches are cumbersome;

Gas consumed by pilot flames is not a negligible quantity;

Gas will provide ventilation if ceilings are especially designed;

Efficient gas at present for the company's own use only.

Factory Lighting Problems, by C. E. Clewell; *Electric Journal,* June.

A very carefully prepared article with illustrations and diagrams which discuss the general features of factory lighting, and then gives a minute analysis of the installation of a particular case in which tungsten lamps were used. This article, which is illustrated with diagrams, is a very clear statement of the physical, electrical, and luminous characteristics of the tungsten lamp, and is free from reference to higher mathematics. An exceedingly good article for those who do not care to go into the higher technicalities.

Some Characteristics of Tungsten Lamps, by J. Franklin Meyer; *Electric Journal,* June.

The Lighting of Small Offices, by C. E. Clewell; *Electric Journal,* June.

The writer treats the subject by the

same careful analytical method that characterizes his writing. Diagrams and all necessary data are given in a plain and easily comprehensible manner. An excellent article for students in illuminating engineering.

The Incandescent Lamp in Use, by B. F. Fisher, Jr.; *Electrical Journal*, June.

A general discussion of the incandescent lamp illustrated with diagrams showing various features as to efficiency, life, etc. Contains much useful information.

High Efficiency Lamps in Load Factor Campaigns, by Roscoe Scott; *Central Station*, June.

The article is devoted chiefly to a discussion of the rate problem as affected by the high efficiency electric lamp.

Economic Production of Light With Incandescent Lamps, by G. S. Merrill; *Central Station*, June.

An analysis of the part which lamp cost plays in the total cost of lighting showing that the economic production of light depends upon the efficiency of the lamp rather than upon its cost.

Principles of Illuminating Engineering, by A. G. Rakestraw; *Southern Electrician*, June.

A second instalment of this series of articles in which the writer deals with the subject of color.

Economy of the Tungsten Filament Lamp for Small Consumers; *Journal of Electricity, Power and Gas*, May 27.

The Metal Filament Lamp and the Isolated Plant, by S. E. Doane; *Isolated Plant*, June.

A short article on Mazda Lamps giving diagrams showing effect of voltage variation and cost of operation of the different forms of incandescent lamps.

Storage Batteries for Automobile Electric Lighting, by George L. Chandler; *Electrician and Mechanic*, July.

Lighting of a Rug Display, by H. Martin; *Progressive Age*, June 1.

A short article on the lighting of rug display racks at Des Moines, Iowa, with reflex lamps.

Improved Street Lighting in Chicago; *Progressive Age*, June 1.

A short illustrated article on the new type gas street lamps recently installed.

Vancouver's Lamp Posts, by W. B. Foshay; *Progressive Age*, June 15.

A short article accompanied with illustrations showing some new ornamental concrete poles for gas arc lighting.

Optometry for Beginners, by R. M. Lockwood; *Optical Journal and Review*, June 1.

Under the above title the chapter in this issue is devoted to the discussion of the illumination in the testing room and the arrangement of the light sources.

A Form of Neutral Tint Absorbing Screen for Photometric Use, by Herbert E. Ives and M. Luckiesh; *Physical Review*, May, 1911.

The writers found the glass screens used by photo-engravers to be free from selective absorption. But such screens can be used only where the light is received on a diffusing reflecting surface. The matter is discussed technically.

Illumination of Libraries, by Melvin Spencer; *New York Architect*, May.

A well written discussion of the subject giving references to the lighting of the New York Public Library and other typical buildings of the kind.

Lighting the Office Building, by Roscoe Scott; *Building Management*, June.

The present chapter of this serial covers the lighting of engine rooms.

Hotel Lighting by Incandescent Lamps, by Roscoe Scott; *Hotel Bulletin*, June.

The present chapter of this serial covers a number of miniature lamps and their application in hotel lighting.

The Movement for Better Lighting; *American Industries*, June.

Matching Colors in Store; *Dry Goods Reporter*, June 17.

A short illustrated article on the use of the Moore light for color matching.

Editorials

Electrical World:

THE LUMINOUS EFFICIENCY OF INCANDESCENT LAMPS, May 25.

A STUDY IN CONSERVATION, May 25.

A NEW FORM OF ARC LAMP, May 25.

THE REFLECTING POWER OF METALS, June 15.

Electrical Review and Western Electrician:

THE COST OF STREET LIGHTING, May 27.

ULTRA VIOLET LIGHT FOR STERILIZATION, June 3.

AN AID TO HETEROCHROMATIC PHOTOMETRY, June 3.

GAS LIGHTING AT ITS BEST, June 3.

THE DANGER OF ISOLATED GAS LIGHT, June 17.

Electric Journal:

ECONOMIC FEATURES OF INDUSTRIAL LIGHTING, June.

Central Station:

THE BRILLIANCY OF MAZDA OR TUNGSTEN LIGHTING, June.

Railway Electrical Engineer:

THE DRAWN WIRE TUNGSTEN, June.

Foreign Items

COMPILED BY J. S. DOW.

Illumination and Photometry

LUMINOUS BACTERIA AND MICROSCOPY, by J. E. Barnard (*Knowledge*, May).

An interesting account of the application of luminous bacteria in taking photographs, etc.

LIGHT AS A PRESERVATIVE OF HEALTH, by Sir J. C. Browne (*Windsor Magazine*, May).

This article is interesting as occurring in a magazine of a non-technical and popular character. It deals mainly with the effect of light on bacteria, and on health generally; some interesting facts are given regarding the influence of certain rays in causing pigmentation of the skin and in combatting tuberculosis.

SURFACE BRIGHTNESS AND PHOTOGRAPHY, by J. S. Dow and V. H. Mackinney (*Photographic Journal*, April; *Electrician*, April 21; *Knowledge*, May).

An account of a paper referred to before in these columns. Its chief interest is in showing the connection between photometry and photography, and the value of an illumination photometer in taking photos of artificially lighted interiors. This is a matter of considerable consequence to lighting engineers, and the taking of photographs of this kind has really to be done by one who is both an expert photographer and has an apprecation of the nature of good artificial lighting.

CALCULATION OF ILLUMINATION FROM LINEAR SOURCES, by J. G. Pole (*E. T. Z.*, May 4).

The article deals with very similar matters to those discussed in the recent paper by this author before the Illuminating Engineering Society (U. S. A.).

IRVING AND STAGE LIGHTING, by B. Stoker (*Nineteenth Century*, May).

An interesting historical article explaining the part taken by Sir Henry Irving in designing the lighting of the stage at the Lyceum.

THE NOMENCLATURE OF PRIMARY AND SECONDARY SOURCES OF LIGHT, by A. P. Trotter (*Illum. Eng.*, London, June; *Electrician*, May 19).

A general article discussing the various methods and terms that have been suggested for defining surface brightness and intrinsic brilliancy and distinguishing between them. The author considers that, although different methods of expressing these two quantities exist, there is no need

to draw any fundamental distinction; brightness of a source itself and brightness due to an illuminated surface are really the same physical quantities.

ILLUMINATING ENGINEERING SOCIETY (LONDON) ANNUAL MEETING, REPORT OF COUNCIL AND COMPLETE LIST OF MEMBERS UP TO DATE (*Illum. Eng.*, London, June, 1911).

The report of the Council contains an interesting summary of the progress of the past session; a special feature is the number of cases in which co-operation with other bodies has taken place and joint meetings have been arranged.

INTERIOR LIGHTING AND THE REFLECTING POWER OF WALLS AND CEILINGS (*Illum. Eng.*, London, June).

Discussion of two papers, by Haydn T. Harrison and P. J. Waldram, read before the Illuminating Engineering Society. The chief feature was the attempt to express in convenient terms the effect of wall papers in practice and to allow for this in drawing up lighting specifications.

THE LIGHTING OF THE HORNIMAN MUSEUM (*Illum. Eng.*, London, June).

RAILWAY LIGHTING. ILLUMINATION OF CARRIAGES, REPAIR SHOPS, ETC. (*Railway Gazette*, May 5).

This number is specially devoted to lighting matters, and contains a variety of articles dealing with different aspects of railway lighting.

LA PHOTOMETRE PORTATIF HOLOPHANE (*Rev. des Eclairages*, May 15).

STREET LIGHTING (*Elec. Rev.*, April 21; *J. G. L.*, May 16).

Electric Lighting

EFFICIENCY OF METALLIC FILAMENT LAMPS, by R. A. Houston (*Electrician*, April 28).

Describes some tests on the luminous efficiency of glow lamps. That of the carbon filament lamp he gives as 2.9 per cent. and that of the tungsten filament as 7.5 per cent.

UNTERSUCHUNGEN AN GLÜHLAMPEN-KLEINTRANSFORMATOREN, by F. Niethammer (*Elek. u. Masch.*, April 30).

FORTSCHRITTE DER ELEKTRISCHEN ZUGBELEUCHTUNG, by W. Wolf (*Z. f. B.*, May 10, 20).

ECONOMICAL LIGHTING OF SMALL TOWNS BY ELECTRICITY, by E. H. Wright (*Elec. Rev.*, May 12).

ELEKTRISCHE STARKLICHTBELEUCHTUNG (*J. f. G.*, May 6).

ELEKTRICITÄT IN SCHULEN (*A. E. G. Zeitschr.*, April).

Gas, Oil, Acetylene, Lighting, Etc.

FERNZÜNDUNG DER STRASSENBELEUCHTUNG IN HASPE, by Brennecke (*J. f. G.*, May 13).

PRESSGAS FÜR FABRIKBELEUCHTUNG UND WERKSTATTARBEIT AUS DERSELBEN GASLEITUNG, by K. Kutzbach and W. Schmidt (*J. f. G.*, April 29).

DEGEA GLÜHKÖRPER AUS KUNSTSEIDE, by E. Müller (*Z. f. B.*, April 30; *J. f. G.*, May 6).

GAS LIGHTING AT THE FESTIVAL OF EMPIRE EXHIBITION (*J. G. L.*, May 6).

GAS LIGHTING AT THE SCOTTISH NATIONAL EXHIBITION (*G. W.*, May 6).

L'ALLUMAGE ET L'EXTINCTION DES LANTERNES D'EXTERIEUR. BECS RENVERSEES (*Rev. des Eclairages*, April 30).

L'ECLAIRAGE A L'ACETYLENE DANS LES MINES GRISOUTEUSES (*Rev. des Eclairages*, April 30).

ACETYLENE IN LABORATORIES (*Acetylene*, May).

ACETYLENE AND METALLIC FILAMENT LAMPS (*Acetylene*, May).

Contractions used:
Elek. u. Masch. *Elektrotechnik und Maschinenbau.*
E. T. Z. *Elektrotechnische Zeitschrift.*
G. W. *Gas World.*
Illum. Eng. Lond. *Illuminating Engineer (London).*
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
J. G. L. *Journal of Gaslighting.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The
Illuminating Engineer

Vol. VI AUGUST, 1911 No. 6

THE GOLDEN RULE

"Do unto others as you would that others would do unto you." This is the summation of all ethical and moral codes. It is a precept laid down in all the great religions and philosophies of the world. A rule that has been independently discovered and proven correct under varying conditions of race, environment and time, must express an absolute truth.

But why should we call it the GOLDEN rule? Probably the word "golden" suggests, to most, its methaphorical senses of preciousness. Possibly also there is an intimation of beauty, the metal having served for purposes of personal and other adornment for untold ages. Both meanings may properly apply to the precept which, like all absolute truths, is both precious and beautiful as well as rare.

It will not profane this sacred law to find still another reason for calling it "golden;" it is by following its truth that you shall obtain gold, and all that it represents in material wealth.

THE GOLDEN RULE PAYS, not only in ease of conscience, but in actual coin of the realm. Neither lasting individual nor national wealth or honor has ever been achieved in defiance of this law.

It is not only right and just in the abstract to afford those who serve you every facility for their work and comfort, but it likewise brings returns in bankable funds. The ill ventilated, badly lighted, poorly equipped factory, store or office transgresses this fundamental law, and pays for the transgression dearly. The clean, well lighted, cheerful and convenient room, such as you would like to occupy or work in yourself, is not only right, but pays in a greater product of better quality.

"The fool hath said in his heart—do others as they would like to do you!" It is a smart sounding, catchy phrase, but it is a lie, "and whosoever is deceived thereby is not wise." The golden rule is safest. "Give the light to others that you would have for yourself."

LET THERE BE MORE AND BETTER LIGHT.

E. L. Elliott.

The Illumination of a Great Railway Terminal

However one may be disposed to question the other claims of Chicago, there is no doubt as to its pre-eminence as a railway center. The Romans liked to say that "all roads lead to Rome," and we can say with equal truth that "all railroads lead to Chicago." It is natural to expect of such a city, therefore, that it should possess the largest and finest railway stations in this country; and as we lead the world in railways, our stations should also be world beaters of their kind.

Until recently Chicago has had mighty little to brag about in this respect; in fact, her railway stations would have been a disgrace to Crim Tartary, the only one that was even semi-modern being the Wabash avenue station of the New York Central and Rock Island lines.

The opening of the new Northwestern Station has removed no small part of this stigma of the railroad city. It is at the present time the second largest railway terminal in the United States, and is certainly one of the handsomest in the world. Probably most critics would consider it the very handsomest station in the United States; but as art, of which architecture forms a part, is one of those matters of taste which, according to the proverb, do not admit of dispute, everyone is entitled to his own opinion in this respect. Following the prevailing mode in architecture, the structure is of the distinctly classic type. It is called by the architects "early Italian Renaissance," but as Renaissance in architecture always means some adaptation of the classical, this fine distinction may be omitted without appreciable error. In accordance with the modern

FIG. I.—ONE OF THE CORRIDORS AND STAIRCASE ON THE STREET FLOOR OF THE NEW CHICAGO & NORTHWESTERN RAILWAY TERMINAL.

FIG. 2.—ENTRANCE TO THE TRAIN SHED.

practice of elevated tracks within the limits of large cities, the building is essentially of two-story construction; the first floor at the street level and the second floor at the track level.

The artificial illumination of any monumental building is no mean task from the engineering standpoint alone; and when such a building is of a distinct type of architecture, which demands harmony in all its decorative features, as well as the proper lighting to bring out the structural characteristics in their proper form, the difficulties of the task are raised to the maximum. A study of the illumination of the Northwestern Station should, therefore, be instructive, showing either how buildings of this character should or should not be illuminated.

Fig. 1 shows one of the corridors and staircases on the street floor. The illumination here is by large lantern-like globes of opalescent glass inclosing tungsten lamps. The vaulted ceiling being constructed of light tinted tiles furnishes an excellent reflecting surface, so the question of distribution was much simplified.

Fig. 2 shows the upper landing of one of the main stairways; the illumination being provided by a severely simple fixture with round opal globes. The white ceiling again simplifies the distribution problem. It should be noted that there has been no attempt here to embody any of the characteristic forms or decorations of classical architecture in the fixtures, reliance being had upon their simplicity to produce structural harmony with the surroundings. If there is nothing distinctly classical about them, there is at least nothing that is *not* classical.

These and other stairways lead to the main waiting-room on the second or track floor, a view of which is shown in Fig. 3. This room is two full stories and a clear story in height, and is the main architectural feature of the interior. The side walls are of a light pink marble, the columns of mottled green and the tiling of the vaulted ceiling of harmonizing tints

FIG. 3.—THE MAIN WAITING ROOM.

and colors. Three systems of light-sources are used for the illumination of this room—namely, massive bronze chandeliers supporting upright globes, suspended between the columns of the side walls; bronze standards similarly equipped in front of the pedestals at each end, and concealed incandescent in the clearstory. A detailed view of one of the chandeliers is shown in Fig. 4. These show a distinct attempt to express classical motives in the ornamentation, and perhaps accomplish the purpose as successfully as can be hoped for in the adaptation of a feature that is so decidedly modern as an electric lamp to a type of architecture several thousand years old; and the same may be said of the standards at each end of the room. The concealed lighting by the lamps in the clearstory serves both to illuminate the ceiling so as to prevent the effect of gloom which dark ceilings invariably produce and incidentally to increase the general illumination of the space below.

This room furnishes an excellent opportunity for discussion as to how far interior architecture and decoration should be subservient to illumination. Should the architect and decorator first design the interior and then demand that it be properly illuminated, or should the illumination be first considered and the decorative scheme be laid out so as to permit the best effects? Both contentions would undoubtedly find adherents. It would seem safe to at least claim a middle course. A room of this kind, involving a great amount of cubic space as well as floor area, is a difficult problem in lighting, and more especially in the case of a railway station which is in commission the entire twenty-four hours of the day, and which of all places should be light and cheerful. The illumination may well engage the serious attention of architect and decorator in the formation of their plans. A slight modification in this case would have made illumination by indirect means an assured and permanent success; and we believe it is a fair and reasonable proposition that such a variation

would not have detracted from the general effect of the room. The variation would consist simply in white or a very light cream color on the ceiling instead of the darker shades used. High power tungsten lamps in suitable reflectors concealed above the cornice, where there is ample room, would then have produced an ideal case of indirect illumination.

Very similar architectural conditions are to be found in the main waiting room of the Union Station in Washington; in this case indirect lighting has been attempted by means of carbon arc projectors, but the scheme is nearly a failure on account of the gray color of the ceiling. Light represents a void, or open space, and therefore very properly belongs to a ceiling, and especially to lofty ceilings of this kind.

The chandeliers in this case are exceptionally well proportioned and placed, offering no obstruction to the perspective of the magnificent marble columns. The unpardonable mistake of suspending them from the top of the arch of the ceiling, as in the case of the St. Louis station, has not been made. Altogether, there seems to be little to criticise in the illumination of this room, unless it be along the lines of the question above propounded.

A view of the concourse is shown in Fig. 5. A chandelier of similar design to that shown in Fig. 2, but of larger dimensions, is placed in the center of each bay. This concourse is 316 ft. long and 68 ft. wide. It contains seven of the chandeliers, each supplied with twelve 100 watt and one 150 watt lamps, and inclosed in Alba globes. The fixtures are 18 ft. from the floor and 20 ft. between centers. As diffusing globes are used, together with the light ceilings, the illumination here should be sufficient and acceptable.

Fig. 6 is a view in the dining-room on the main floor, which is 56 x 70 ft. in area. The illumination here is entirely by the indirect method, two fixtures being suspended in each bay. The bowls concealing the reflectors are of stucco, with classical modeling to harmonize with the interior decoration, each containing four 250-watt lamps. The effect here is ideal from both the engineering and architectural standpoints. The illumination furnished is restful and satisfying to the eyes, furnishing an agreeable change from the glaring light-sources which are put up for the affliction of passengers in the great majority of railway coaches, while the fixtures themselves correspond in both material and design to the classical treatment of the interior. It would be difficult to conceive of more perfect harmony, and there are few examples of more faithful and satisfactory adherence to this perenially admired architecture.

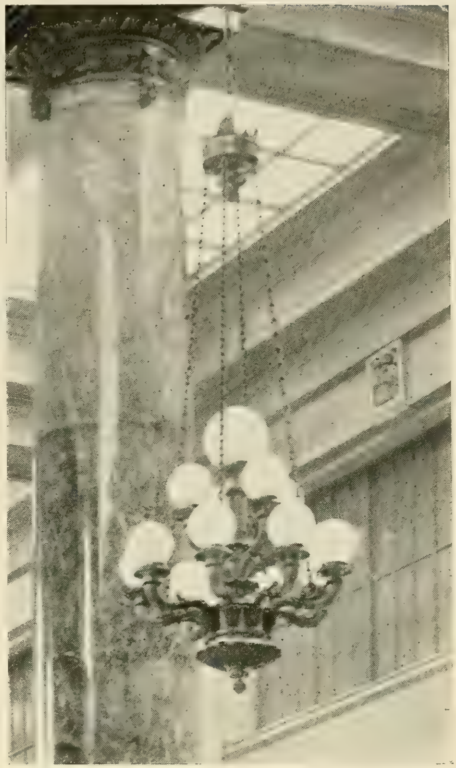


FIG. 4.—A DETAILED VIEW OF ONE OF THE FIXTURES.

Fig. 7 shows one of the retiring rooms illuminated in the same manner. Of all appliances and facilities intended to rest the traveler, none will be more acceptable, though, perhaps, unconsciously appreciated, than the removal of the usual glaring light-source. There is perhaps nothing more wearying to the eye than railway travel, either by night or day, and the necessity for providing for its rest in the station is all the more necessary.

FIG. 5.—CONCOURSE.

FIG. 6.—DINING ROOM ON THE MAIN FLOOR LIGHTED BY SEMI-INDIRECT ILLUMINATION.

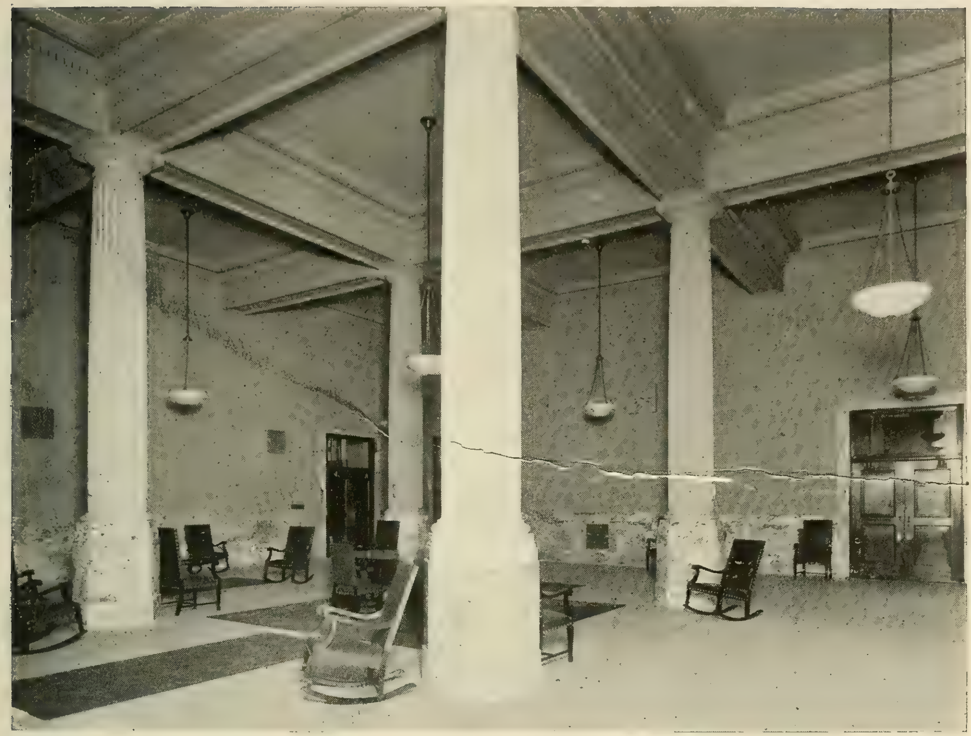


FIG. 7.—ONE OF THE RETIRING ROOMS, USING ELABORATE ALABASTER BOWLS FOR SEMI-INDIRECT ILLUMINATION.

Fig. 8 shows a restaurant on the ground floor in which the lighting is by lamps in alabaster bowls. While these are exceedingly handsome, they have proven inadequate as a lighting unit, and will be replaced by some other type of fixture.

The illustrations show only a few of the rooms in this immense structure. On the third floor there are various rooms suited to the needs of the traveler, some of which are unique in railway terminal facilities. Thus opening from the corridor that leads into the woman's retiring room is a handsome tea room, which is wainscoted with tile to the height of the doors and having a moss green tile floor. The illumination here is by the indirect method; the bowls being suspended 10 ft. above the floor and are equipped with four 150-watt lamps.

The corridors are lighted by 100-watt lamps in Alba balls suspended 12 ft. above the floor. A unique feature of the lighting is that the landings of the several large stairways, which, beside the ceiling fixtures, receive the light from linolite lamps recessed into the side walls 18 in. from the floor. There are also side brackets equipped with 40-watt lamps inclosed in Alba reflectors.

Operating offices of one of the divisions of the Northwestern road occupies part of the third and all of the fourth floors, and are illuminated by Benjamin clusters containing two 40-watt lamps each.

The train sheds, which are of the low roof, or umbrella type, are illuminated with 100 and 125 watt lamps placed 20 ft. apart along the lines of the supporting arches of the roof.

A novel feature is the use of searchlights, which throw a powerful beam vertically into the sky which serves as "a pillar of light" to guide the traveler seeking the station by night.

The rooms for handling the mail, which are on the street level, are illuminated by double tube Cooper Hewitt lamps.

In considering the illumination of a public building decorative curb lighting must receive due attention. In this case there are sixty-one handsome lamp standards used about the façades of the building. The eight directly in front are equipped with three 150-watt lamps in the top globe and 100-watt lamps in the four lower globes. The other standards are equipped with four globes, each containing 100-watt lamps.

While the illumination of the main waiting room is undoubtedly successful, at least so far as intensity of illumination and artistic effects are concerned, there seems to be some question as to the efficiency; but in a building of such character as this, which is intended to serve to a degree as a model of architecture, as well as affording every possible comfort to the traveler, mere mechanical efficiency is of secondary moment. In some of the other rooms the illumination is not so successful, particularly where indirect lighting has been installed; the trouble being undoubtedly due to the color of the walls and ceilings.

The opinion has been expressed that such faults in illumination as exist, and there are undoubtedly some faults, may be chargeable to the fact that there was not a sufficient amount of co-operation between the architect, the electrical engineer and the illuminating engineer. Had there been such co-operation between these three essential elements in the perfection of any lighting system, such, for example, as existed in the working out of the Soldiers' Memorial Building in Pittsburg, such faults might have been entirely obviated. Artificial light cannot be relegated to the rear in the case of any building which is conspicuously used at night, and illuminating engineering is as essential to complete success as electrical or mechanical engineering.

Whatever faults may be developed in the minor rooms of this building, as a whole, the lighting is more successful than that of most buildings of such a nature.

FIG. 8.—ONE OF THE RESTAURANTS ON THE STREET FLOOR.

FIG. 9.—AN END OF THE MAIN WAITING ROOM.

The great Union Station in Washington, as already mentioned, is badly lighted within, and worse without. The magnificent Congressional Library in the same city is an atrocity in lighting, being scarcely equaled in this respect by the twelve-million-dollar library recently opened in New York City. The Pennsylvania Terminal, at present the largest railway station in the United States, has some serious faults which will need correction—in fact, are already receiving the attention of the proper authorities. The new Union Station in Worcester, Mass., discloses many anomalies in lighting both from the engineering and architectural viewpoints.

With these examples of partial failure before them, there will be little excuse for the architects of the great New York Central Terminal, which will be, when completed, the largest railway station in the world, for a repetition of the fifty-seven varieties of errors which exist in the other cases. The pitiful part of the whole story is the needlessness of such mistakes. The lighting of any of these buildings is by no means beyond a thoroughly successful and satisfactory solution. While the illuminating engineers that can handle such problems are perhaps not numerous, there are certainly a sufficient number available to make such failures entirely chargeable to the architects.

Illumination at the Turin International Exhibition

Exclusive correspondence of THE ILLUMINATING ENGINEER.

The Turin International Exhibition is a great event, not only for North Italy, but for all Europe. It is about as fine an exhibition of international importance as has ever been held on the Continent, always excepting the great shows of Paris. Something exceptional has been done this year in the matter of illumination. It is very rare that gas has played an important part in the lighting up of the gardens, since electricity became easily handled and reliable, but observers of illumination in the various principal towns of the world are now aware that compressed gas has been received with such favor on its individual merits as to revive the hopes of the gas manufacturers that it may retain its position as a public illuminant for many decades to come, and these hopes are strengthened by the well-known fact in London that there are complete localities where it has been put in the place of electricity which had originally pressed it out.

In Turin, too, there is a strong disposition obvious to give compressed gas an opportunity to assert its alleged superiority to, or, at all events, its equality with electric light. In the exhibition itself the Illuminating Gas Consumers' Company of Turin has been intrusted with the lighting up of a large part of the grounds at night. For the purpose of illumination the gardens have been divided into two parts, the dividing line having its origin in the Ponte Isabella. Above this bridge the gardens are lit up by compressed gas; below it the gardens and buildings are lit up by electricity, partly arc lamps, partly incandescent. It would be hard to tell which produces the finer effect. There must be amateurs for both.

The beautiful, brilliant, yet soft, light of the compressed gas certainly strikes the eye as a thing of beauty and it lights up all around it, showing off the details of the architecture in a manner that testifies to its value as a diffuser of light, which, of course, has long been admitted to be one of the advantages of gas over elec-

FIG. I.—NIGHT VIEW AT THE TURIN INTERNATIONAL EXHIBITION.

FIG. 2.—ANOTHER VIEW OF THE TURIN INTERNATIONAL EXHIBITION, SHOWING THE BRITISH SECTION LIGHTED UP FOR CORONATION DAY.

tricity which throws to the disconcerting of architects and others such strong shadows. The company entrusted with the gas light has put up several hundred lamps of power varying from 1000 to 5000 candles each, and it must be stated that the effect of this lighting is to give the gardens above the Ponte Isabella an appearance of fairyland.

Down stream it is a different light that strikes the eye. It is a soft, mellow light that is natural to the incandescent lamp, but which, of course, gets its softened quality, as far as the arc lamps are concerned, from the globe. The effect of the electric lighting is equally striking, though in a different way. It is not so bright, is more subdued, and, if anything, may be said to get better control of the senses of the onlooker. The number of electric lights is naturally much larger than that of the gas lights, because so much is done with the incandescent lamp which lends itself so completely to architectural decoration. With the electric lamp the monumental bridge and the buildings both sides of the river to and from which it leads are brilliantly illuminated, the lines being revealed in long rows of lights.

It should be stated that the choice of the executive has been to give the best parts of the gardens to electricity. Whether this has been done simply on the merits of the lights or whether they have been afraid to give too much play to compressed gas which is comparatively new everywhere, and almost quite new in North Italy, one cannot say; but this can be averred without fear of contradiction, that in both sets of gardens the illumination is a brilliant success in the every sense of the term. The accompanying pictures show the British section lit up on the evening of Coronation day. The picture was taken at different distances and at different periods of the evening.

A New System of Gas Lamp Ignition

By R. F. Pierce.

One of the drawbacks of gas lighting as ordinarily used—real in some cases, imaginary in most—is the absence of convenient and satisfactory means for the remote control of lighting and extinguishing.

The well-known pilot ignition system with magnetically controlled supply valve has been largely used and with good results. All the most desirable features of remote control are obtained and the gas consumption of the pilot burner is practically negligible. This system has a further advantage of rendering the location of the lamp easily discernible in the dark—an excellent feature when the light is turned on by a pull chain.

In installations, however, comprising a number of infrequently used lamps lighted by this system, the aggregate consumption of the pilot flame is generally believed by the consumer to be quite an item. The annoyance of blown out pilot flames is also generally exaggerated, both as to frequency of occurrence and as to the results arising from the release of unburned gas into the room, and the average user has the idea that this system is more or less awkward and undesirable. As the whims of the customer are, from a commercial standpoint, quite as important as the real facts in the case, and trifling considerations are quite enough to decide in some cases the selection of lighting systems, the designers of gas lighting apparatus have given much attention to the development of ignition systems absolutely free from even the most inconsequential and imaginary disadvantages.

The most practical means of raising coal gas to the ignition temperature without supplying heat from outside sources is found in the power of platinum, in a finely divided state, to condense oxygen upon its surface in such quantities and in such a form as to rapidly combine with the hydrogen of the gas. The heat generated by this combination is sufficient to raise a mixture to the ignition point, and this means of automatic gas lighting has already been practically applied to a considerable extent. The self-lighting gas mantles bearing a spot of platinum black upon their surfaces depend upon this action, and many of the various matchless pocket gas and cigar lighters now on the market are similarily constructed. This sytem is, however, lacking in durability and reliability. After a time the small particles of platinum are welded together into larger masses of decreased surface area and the volume of occluded oxygen is decreased, thus diminishing the catalytic action upon which ignition depends. It has been found, however, that if a filament of platinum alloy be heated to about 500 degrees C. in the presence of a gas containing hydrogen, catalytic action will ensue and raise the gas to the ignition point. By proper selection of the metals incorporated in the alloy, the filament is obtained which does not deteriorate with repeated and continued use. Among the results obtained by the use of proper alloys are:

First. A higher melting point, obviously desirable.

Second. Chemical inertness to gas impurities.

Third. Greater catalytic power, permitting ignition with the least possible amount of electrical energy—plainly an important factor when the energy is supplied by a dry battery.

The first two features have to do directly with the durability and reliability

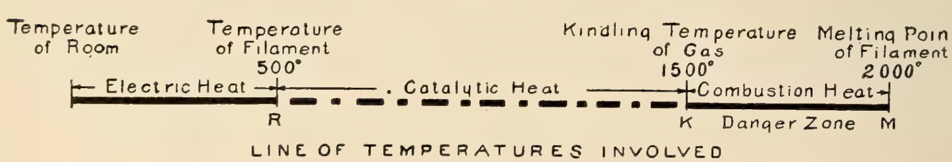


FIG. 1.

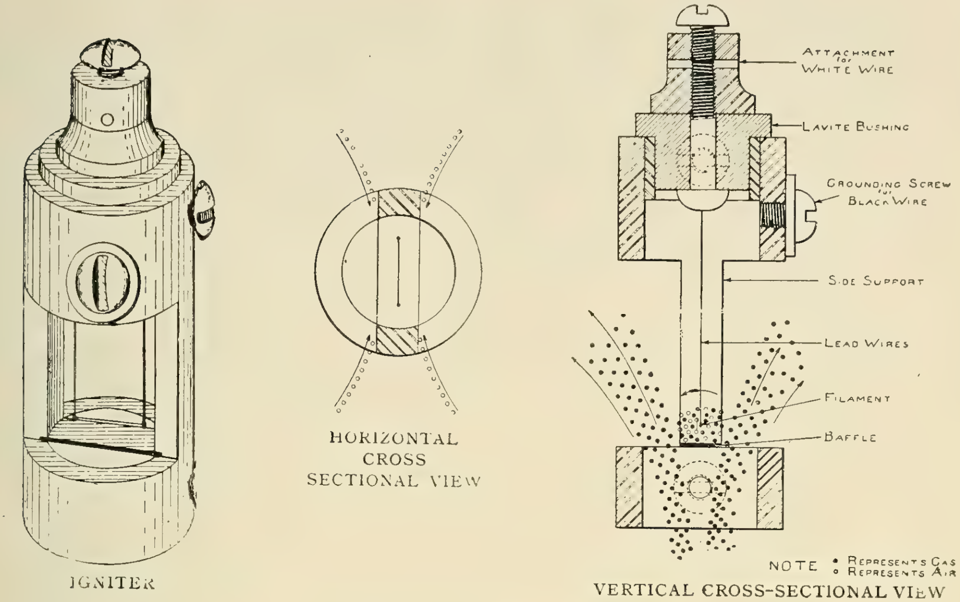


FIG. 2.—DIAGRAM OF THE IGNITER.

of the filament, in which respects pure platinum is deficient.

The development of a suitable alloy has naturally entailed much research and experimental work, which has fortunately met with complete success. Alloy filaments have been constructed, giving an average life of 60,000 ignitions under laboratory conditions.

In order to arrest catalytic action after the ignition point has been reached and thus prevent the destruction of the filament, it is necessary to control the quantity and quality of gas mixture reaching the filament during and after ignition.

By inspection of Fig. 1, it will be seen that a range of 500 degrees C. exists between the kindling temperature of gas and the melting point of the filament. The filament being extremely small rises in temperature very rapidly, and it will thus be seen that any device capable of arresting the temperature rise within such a small range must act quickly and positively.

Fig. 2 shows the form of the filament-igniter and tube, and Fig. 3 shows the tube mounted above the crown of the burner as ordinarily used.

It may readily be seen that as the gas escapes into the mantle it will be forced up by its buoyancy, and some portion of the gas, mixed with air, will find its way through the crown nipple into the igniting tube, the stream being finally divided by the baffle plate (see Fig. 2), and thus escape into the air above the burner.

As the two streams of gas rush past the baffle plate, some molecules of gas will find their way into the space above the baffle and mingle with the air that is being drawn in about the side supports.

If the velocity of the gas streams should differ in any way, this mass of mixed gas would be given a whirling motion that would insure a good mixture, and at the same time prevent an excessive accumulation of gas. By this means the quantity of gas finding its way to the filament is kept down to an amount that will insure lighting without endangering the life of the filament at the moment of ignition.

Of course, the moment ignition occurs, the filament takes only such a temperature as is given by the heated products of combustion issuing from the burner.

The baffle plate continues to do useful work after ignition by shielding the filament from the direct stream of the hot products of combustion, while the two

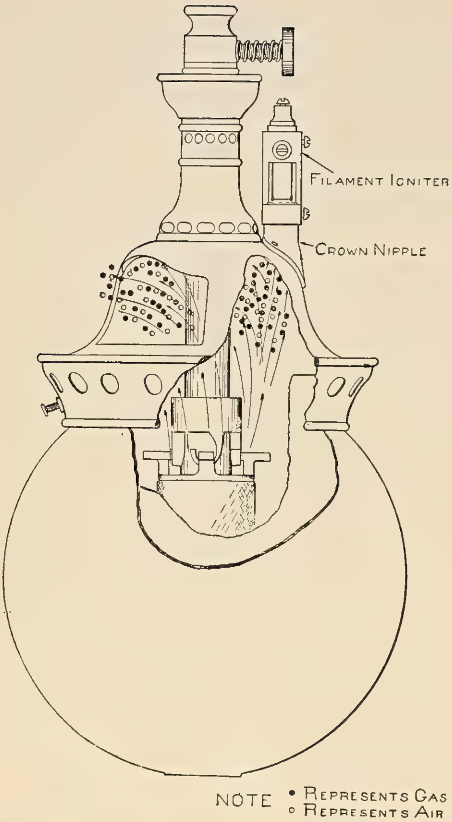


FIG. 3.—DIAGRAM SHOWING OPERATION OF THE NEW IGNITER.

streams tend to cause an inrush of air indefinitely from the sides. The inrush of air upon a heated wire tends to make it more sensitive to future ignitions, probably by virtue of the power that the platinum metals possess of condensing oxygen upon the surface.

It might not be thought that the baffle plate could serve any marked purpose, but this simple mechanism means a difference between one or two possible ignitions and many thousands. After many thousand ignitions a delicate filament will become disintegrated, but a new one may readily be added to replace it.

Fig. 4 shows the igniters attached to the burners of a self-contained fixture. By pulling the chain a simple mechanism within the shell turns the gas into the burners and at the same time closes the circuit involving the dry battery shown in the cut, and thus the filaments are heated when the gas stream finally reaches the baffle plate. When the chain is released, the gas continues to flow through the lighted burners and the circuit is automatically broken.

The dry cell may be replaced by unlocking the shell and inserting a new one. While a dry cell will give 100,000 successive ignitions, this does not mean that one dry cell will light a burner two or three times a day for one hundred years, for a dry cell will deteriorate by simple idleness.

While this system has thus far been applied only to a certain type of self-contained fixture, it is obvious that in connection with a magnetically operated supply valve, this system permits the control of gas lights from wall push-buttons, or any other convenient means.

Gas lamps which require hanging too far above the floor for pull chain lighting would entail no more inconvenience or attention than those more favorably placed. This permits a much greater flexibility in the installation and use of gas lighting fixtures, and outside of a limited class of decorative lighting, there is no sort of permanent installation which might not be

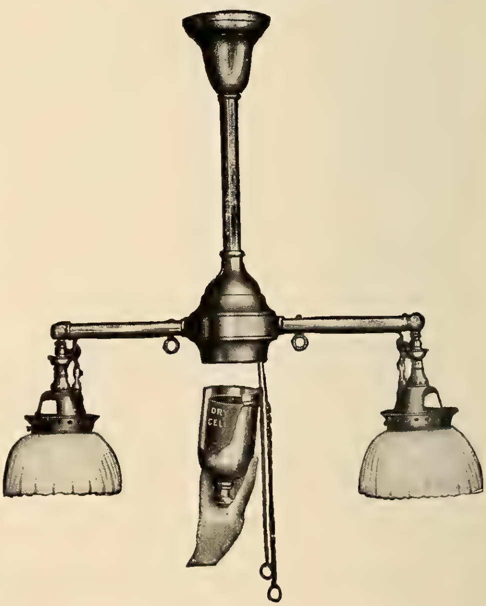


FIG. 4.—TWO-LIGHT FIXTURE, WITH PULL CHAIN FILAMENT IGNITION, SHOWING REMOVABLE BATTERY CUP.

treated with the utmost freedom by the use of gas lamps. This marks an exceptionally important step forward in the lighting industry.

From both optical and hygienic standpoints the superiority of gas lighting is quite generally acknowledged by those who have given the matter careful attention, and in spite of the lack of the aggressive exploitation and numerous conveniences enjoyed by some other illuminants, it is still the leading artificial illuminant. With the development of means of lighting and extinguishing as positive, reliable and convenient as those available with any other illuminant, the use of gas lighting will undoubtedly receive a great impetus.

From a commercial standpoint, the filament ignition system should be extremely attractive. On account of the low voltage and very small amount of energy required, the wiring could be installed at a small fraction of the expense necessitated by wiring for electric lights. As there would be no necessity for using knobs, tubes, conduit or moulding to insulate the wires, this system could be installed rapidly and with an insignificant amount of material. In fact, the cost of wiring an unfinished house would be practically negligible. The effect of this development upon gas lighting can hardly be overestimated.

It is hard to conceive of any really important respect in which gas lamps or fixtures (equipped with magnet valve control and filament ignition) would be lacking in any requirement imposed by modern demands for convenient and satisfactory control.

It will be interesting to note the manner in which gas lighting companies make use of this new and powerful weapon in obtaining new business.

The Ultimate Relation of Illuminating Engineering to Public Utility Corporations—An Analysis

By F. Laurent Godinez.

1—(Continued) Motives Governing the Operation of Public Utilities.

In the previous issue, a few of the obstacles restricting the conductance of a policy of public relations by a public utility corporation were classified.

The element of dissatisfaction which exists amongst a certain class of consumers, who not alone displeased with the bills rendered for service, are also at odds with themselves, their state of being, and the world in general, offers an ideal environment for the machinations of those pseudo-specialists who, like buzzards, hover over the unwary consumer of gas and electricity.

In comparatively few instances have audit and rebate companies been conducted on a strictly legitimate commercial basis. The merchant naturally feels quite competent to cope with any of the technicalities of strictly mercantile procedure, but holds up his hands in abject surrender at the approach of that mysterious and cordially hated symbol of ill omen, the kilowatt. Even the inoffensive watt, a perfectly harmless member of the same family, is regarded with deep suspicion, and this attitude on the part of the merchant is due to the fact that either he will not or can not take the time necessary to become familiar with the characteristics of simple electrical terminology.

He is, moreover, impervious to any plausible or logical explanation advanced by the lighting company's representative, but lends a willing ear to such studied phrases as " They are robbers "—" They have ' fixed ' your meter "—" These criminal monopolies," and other typical phrases insidiously innoculated by some self-appointed champion of right and justice. Fortunately the evil of the audit and rebate company, like other evils has confined itself in a measure to the great centers of civilization, and owing to the concerted effort of its many victims is achieving a well merited and inglorious annihilation. At the start its *modus operandi* would apprise any one of its true ulterior motive save such individuals as

might be rendered temporarily irrational through hypochondriacal or misanthropic suggestion.

A carefully worded contract, skillfully covering a nominal fee, payable *in advance,* however, furnishes the alluring bait. The low service charge coupled with the victim's abnormal state over his fancied wrongs prompts him to seize the proffered pen and sign. A check completes the transaction. When the victim realizes his error it is too late. His attorney shakes his head over the contract and points out its agreement to do—*nothing.* His client departs in a highly chastened and ofttimes enlightened mood. But the sting remains. The next applicant for his favor may be a real illuminating engineer, and is curtly admonished not to discuss the order of his departure but to close the office door immediately — from without. Thus does patient *Merit* smile upon the unworthy, and in every similar illicit infection of public sentiment we find the inevitable reflex action in the form of injury to worthy endeavor. On rare occasions when the performance of such a contract merits satisfaction, analysis reveals that the same result could have been attained through co-operation between the merchant and the lighting company without the intervention of a third party. Frequently the audit and rebate company finds upon examination that their client should be enjoying a more advantageous contract. When this is obtained by negotiations conducted through correspondence (on the client's stationery) with the illuminating company (dictated by the rebate company) an appreciable saving is often effected, accompanied, of course, by rejoicing on the part of the client. But he himself could have accomplished the same saving by notifying the illuminating company that his installation had been increased to the permissible limits of contract modification. The audit and rebate companies which are still in existence operate in general along the above lines, with the exception of the advance fee. This is eliminated, and they take their chances on a 50 per cent. profit sharing basis with their client on any economy effected. The representatives of these concerns are generally men who have unsuccessfully tried everything else. Showy clothes, "diamonds," and the indigenous personality of the habitual free-lance—all these form an ensemble scarcely calculated to inspire confidence on the part of the normal business man, yet the seed of ignorance and discontent is sown, and the harvest is not difficult to reap. If the representatives or executives of these concerns were men of broad perspective they would realize what genuine illuminating engineering could accomplish, not only in legitimizing their vocation but in facilitating their endeavors to give satisfaction. Aside from the work of one such company, organized in Philadelphia and still in existence, no attempt has been made to conduct such a business properly, and the success in that particular instance was due only to the fact that its organization was made by one who was and is an important factor in the field of applied illumination design.

Of the "anti-wattage engineer" it is scarcely necessary to speak. Originated by manufacturing interests, this "movement" has passed into disrepute.

With the continued advent of high efficiency gas and electric illuminants, the field for that sort of thing has become too narrow for occupancy. To-day light is cheap in *cost,* and the great problem which must be faced by modern illuminating engineers is to prevent it from becoming cheap in *appearance.* The day of certain methods and advanced idealism in the art of illumination is at hand and offers but scant encouragement to the pretender.

The movement of illuminating engineering has grown beyond even the expectation and hopes of its promulgators, and occupies an individual sphere which is preserving its equilibrium and gathering momentum with each revolution.

Probably a more serious retardation factor in public relation policy than those previously considered occurs in the person of the corrupt politician, abetted by his unfailing ally, the lobbyist. This representative of the people's choice enriches himself at their expense by championing the cause of municipal ownership.

It is unnecessary to speak of the incompetence of political appointees; we are surrounded on all sides by "horrible examples." When elected, the ethics of politi-

cal reciprocity demand that the candidate-elect shall not repudiate his "constituents." As a result a series of incompetents, lacking in everything save the ability to influence voters, are placed in responsible positions which should only be held by competent, intelligent, technical workers.

Given municipal ownership and we have yet to see where it has done anything to better the conditions and *growth* of its community. The illuminating company, under franchise, operated by private capital, must obviously be dependent upon *expansion* for its existence. The municipal ownership is not. It will continue to eke out a monotonous routine for years without leaving a single mark of progress on its city. It doesn't have to make money. It simply has to pay expenses. Therefore expansion doesn't trouble it, and the town remains dark.

With the private corporation all that is different. Dark streets are made bright and alive with humanity—the acquisition of valuable manufacturing interests follow, then the revivification of a lackadaisical board of trade or chamber of commerce, an extension of the residence zone and the increase of semi-prosperous homes—eventually a realization of the city beautiful. These are a few of the results of private ownership. Place the records of municipal control on the other side of the scale and try to get a balance. It is not possible.

(*To be continued.*)

The White Way in Reading, Pa.

The city of Reading is in the rich agricultural section of eastern Pennsylvania, and to any one reasonably familiar with the various types of people which go to make up our country, this stamps it as one of the cities of the "Pennsylvania Dutch." The title is a technical misnomer, for the original settlers, as is commonly known, were not Hollanders, to whom the word Dutch properly belongs, but Germans or Swiss. The German origin is plainly shown in their *patois*, which is likewise known as "Pennsylvania Dutch." They have maintained their personality to probably a greater extent than any other class of descendants from our original settlers; among their traits industry and frugality are most prominent. They work hard for comparatively low wages and save their earnings. As a result, they are prosperous and remarkably free from poverty.

This brief historical statement is pertinent to the subject, as we shall presently see. Not wishing to be outclassed by other cities, the merchants and other business men of Reading decided that they should have an installation of decorative lighting, commonly known as a "White Way." The most prominent business section of their city is Penn Square, a stretch of avenue 120 ft. wide and 1000 ft. long. For nearly 200 years this square was utilized as a public market, after the manner of the German cities from which the inhabitants came. The two-story stone building at the right, now used as a bank, was built more than 150 years ago, and is cherished as a historic relic, being one of the innumerable houses in which Washington once found shelter.

But, unlike the merchants of most other cities in the United States, they decided that public lighting was a public improvement which should be paid for out of the public treasury, and they succeeded in persuading the people and city officials of the correctness of their view. In most other cases the merchants have gone down into their own pockets and supplied the funds for putting in and maintaining the White Way systems. The Reading merchant could not see why he should pay for lighting the streets any more than any other taxable citizen. He wanted the light and was willing to pay what he considered his share of it, but no more.

Equally characteristic is the fact that his fellow citizens took the same view of the case and were willing to pay their portion of an expense which unquestionably redounded to the benefit of the entire community. This is strict adherence to a rigid and just code of ethics. Public light-

FIG. I.—PENN SQUARE, READING, PA., SHOWING ORNAMENTAL EFFECT OF NEW LIGHTING INSTALLATION.

ing, in their opinion, was neither public charity nor private advertising, but a municipal improvement. And who shall say that their view of the case is not an entirely sane one?

A night view of the square is shown on the front cover of this issue. The light-sources are 320 watt magnetite lamps, with diffusing globes placed on ornamental poles placed 96 ft. apart, the lamps hanging 17 ft. above the pavement. The lamps are burned all night every night in the year.

The expense of installation was borne by the Metropolitan Electric Company, the local central station. History is already repeating itself in this as in nearly all other installations of the kind—that is, it is to be extended for a mile on Penn street, which is their other principal business thoroughfare. Trust the Pennsylvania Dutch to know a good thing when they see it!

"One good turn deserves another," and the unsightly poles carrying overhead wires will now probably receive attention at the hands of the officials and citizens, whose civic pride has been stimulated by the new and better lighting.

The lamp-post in the foreground in the above illustration is practically lost from view by the background furnished by the wooden pole behind it. This extension of improvements, all of which go to make up "The City Prosperous" as well as "The City Beautiful," is not the least among the advantages which follow in the wake of good lighting.

FIG. I.—NIGHT VIEW. DRAWING OFFICE OF THE BRITISH THOMSON-HOUSTON CO., LTD., RUGBY WORKS.

The Illumination of the Turbo Drawing Office, The British-Thomson-Houston Co., Ltd.

BY F. W. WILLCOX.

The drawing office, which consists of a long, narrow room, measuring about 120 ft. long by 16 ft. wide by 11 ft. high, is equipped with a row of 23 drawing boards and reference tables against the outside wall, and on the inside with desks for the chief draughtsman, clerks, typists, etc. The lighting, which is effected by means of Mazda Holophane units throughout, is carried out in the following manner:

Each drawing board is equipped with an inclined bracket provided with a 45-watt half-frosted Mazda lamp in focusing Holophane reflector, these brackets being fitted with a special back plate, so as to admit of their support by means of a picture rail running the entire length of the drawing office half-way up the window frames and fed by a flexible cord. It is thus possible to move the brackets along the wall for any rearrangement of desks that may be required, but in the ordinary course of events each bracket is secured by means of one screw, which prevents accidental movement.

The rest of the room is lighted by a row of 60-watt lamps in intensive Holophane reflector, giving even illumination up to and including the reference tables. The arrangement of light is such that there are no appreciable shadows on the drawing boards and the light for each board comes from the left hand top corner.

The illumination intensity varies from 4 to 4½ foot-candles on the boards to 2 foot-candles for the rest of the room, which is found to be entirely adequate for the work in hand.

Special Illumination from a Tubular Source of Light

By William S. Kilmer.

V.—Small Theater Lighting.

The accompanying photographs describe a rather unique stage lighting installation for a small theater with a seating capacity of 300. Theaters of this class are found in our small cities and suburbs, and are used extensively for combination motion picture and vaudeville houses. This particular installation is in the lyceum or amusement building of a church parish.

The first requisite in this class of work is, as in all other illuminating plans, to keep the installation and operating cost as low as possible; consequently a complete theater board with dimmer, etc., is quite out of the question.

This particular stage is of the regulation outline, complete with drops, wings, etc., the footlight trough following the circular line in the front of the stage in regulation manner, and is metal lined and approximately 7 in. deep, with the usual requirements which are demanded by the underwriters for theater work. The stage settings, as shown in the photographs, occupies a space 15 x 20 ft. The distribution of light about the single unit which is utilized in the trough is shown in the accompanying curve, Fig. 1. It will be noticed that the shape of the reflector gives a distribution of light to conform with the various dimensions which are encountered in this class of stage lighting.

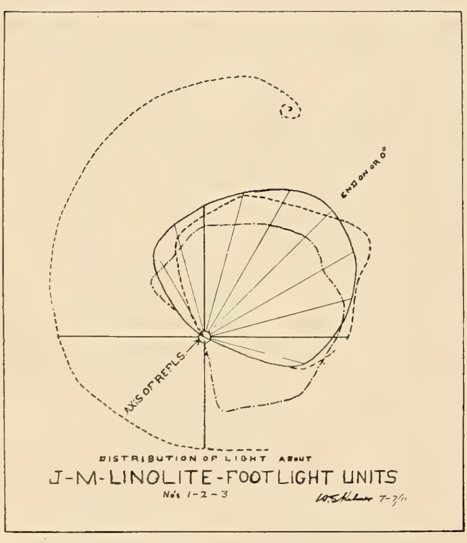


FIG. 1.—PHOTOMETRIC DISTRIBUTION OF FOOTLIGHT UNITS.

The total number of linolite lamps in the footlight trough is 16 units, 12 of which are the 35-watt 30-volt tungsten lamps, burning four in series, and four 56-watt carbon lamps on a separate circuit, which are used for a dim stage effect. These lamps are situated one at each end, the intervening distance being divided equally between the other two lamps. These four carbon lamps are, however, used in connection with the twelve tungsten lamps for full illumination. The illumination falling upon a performer or setting directly in front of the footlights is approximately 8 foot-candles.

The border lights (effect of these lights is noticed in Fig. 2) consist of 8 units occupying a space in the flies 4 ft. toward the center at each end of the stage, there being no direct overhead illumination. The illumination for the center of the stage is reflected from these units, and in this manner a stronger facial expression is obtained. The illumination on the horizontal plane at table level, from both footlights and border lights, measures approximately 5 foot-candles. The distribution of light about the border reflector with four 35-watt lamps is shown in Fig. 6.

One of the remarkable features of this installation is that the footlights are made up in two 8-ft. sections, with a radius corresponding to the footlight trough. The light-source and reflectors are mounted on a continuous 8-ft. length of ¾-in. conduit, which is connected at the exact center by a coupling, rendering the 16-ft. section

FIG. 2.—STAGE, SHOWING EFFECT OF ILLUMINATION, WITH BORDER LIGHTS TURNED ON.

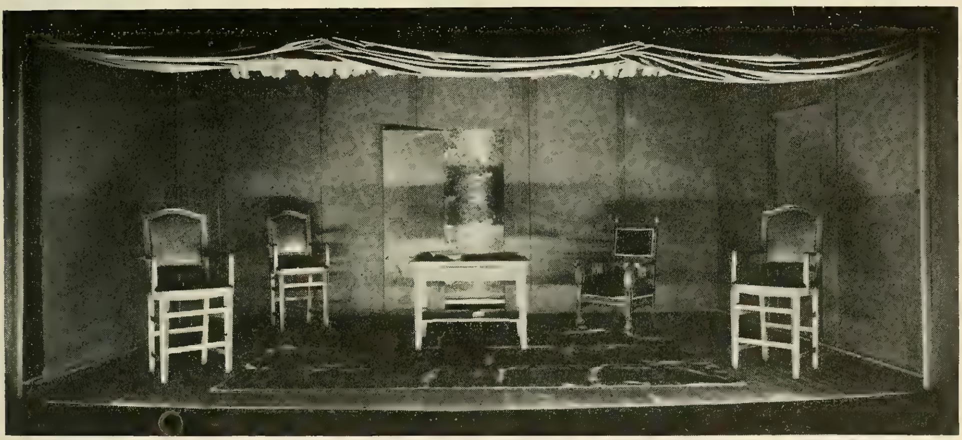


FIG. 3.—ILLUMINATION BY FOOTLIGHTS ONLY.

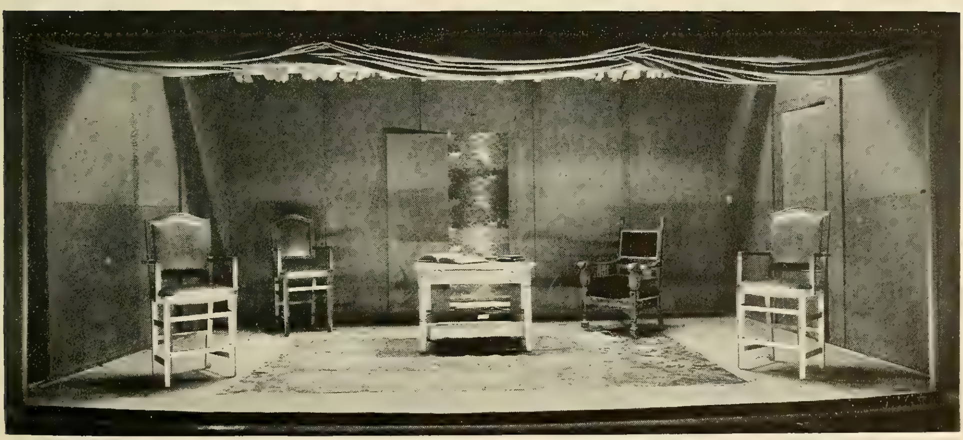


FIG. 4.—THE COMBINED ILLUMINATION BY FOOT AND BORDER LIGHTS.

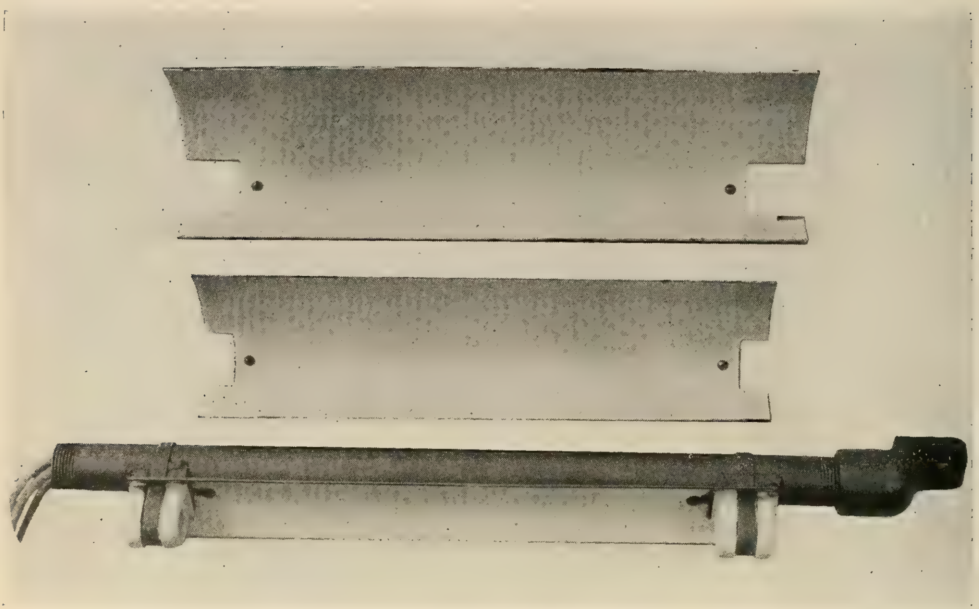


FIG. 5.—TYPE OF UNIT USED.

practically one unit. This unit is then strapped to the portions of the trough which are provided for this purpose, and all that is necessary is to tap the two circuits to the outlet, which is controlled from the switchboard. One circuit, as previously stated, controlling the four carbon lamps and the other the twelve tungstens. The illumination effect from footlights alone is shown in Fig. 3.

The border lights are in a separate circuit and operated from the switchboard. The construction of these units is a continuous metal trough, with aluminum regular reflecting surface. This trough is attached to the overhead strip by means of two knuckle joints and bracket, which attach to the girders. These joints are at times necessary to alter the lighting effect. The combined illumination effect of both border and footlights is shown in Fig. 4.

It is quite possible that this installation might be installed in two hours by one workman, this being a point the writer desires to bring out, as it opens up a field for the illuminating engineer, contractor and central station man, which has been somewhat neglected, and is in an unsatisfactory condition.

It might also be noted that an equipment of this kind could be a part of the property of anyone interested in the small amusement business, as the reflectors shown in Fig. 5 will, when the occasion demands, make a very suitable unit where a submerged space is not available.

The three distribution curves shown in Fig. 1 are for the reflectors shown in Fig. 5. The trough represented by a dotted

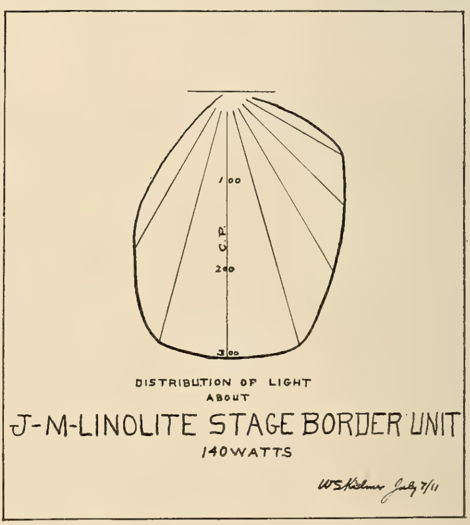


FIG. 6.—PHOTOMETRIC DISTRIBUTION OF BORDER LIGHT UNITS.

line in Fig. 1 consists of a non-reflecting surface; consequently the distribution is not materially altered.

It is quite interesting to note that the total current consumption for Fig. 2 is 280 watts, Fig. 3 is 420 watts, Fig. 4 is 700 watts, and the effects are all that can be desired for this class of work.

England Discovers the Electric Light

If reports from England are to be credited, the electric lamp is about to enter into serious competition with the time honored candle. The accompanying illustration depicts the surprise, not to say consternation, with which this fact is received by our cousin John. Groping his way along with his customary tallow tip, Mr. Bull has apparently suddenly run afoul of an electric bulb. This is evidently his first encounter with this new lamp, and the shock of its dazzzling light causes him to drop the candle which has so long lighted him to bed. After he has fairly recovered from the shock, we may assume from the authorship of this cartoon that he will immediately have this modern light-source installed throughout his mansion—probably on drop cords, and covered with tin reflectors.

The European, including the Englishman, is in the habit of ascribing a lack of appreciation of art and architecture to the American, and probably with a considerable degree of justice; but the American has ample opportunity for counter charges, one of the most conspicuous of which is the crude methods of illumination which pass without comment in England and generally upon the Continent. Electric lamps suspended on ordinary drop cords and at best supplied with the cheapest kind of reflector are common methods of illumination in both public and private rooms of elegant proportions and furnishings. The representation of the electric light so installed in the illustration is not a slip of the artist, but the expression of a common fact.

The standard of illumination in mere point of intensity is also much less as a general rule. An English illuminometer imported some three years ago, which was supposed to measure all practical ranges of illumination, was found to stop about midway in the scale of American practice.

The British Illuminating Engineering Society, and its official organ, *The Illuminating Engineer*, however, have undoubtedly been a potent factor in educating the public to better practices and to higher standards of illumination. The Englishman does not move as rapidly as the American, but he has a fixed habit of staying when he once "gets there." We do some things better in America and they do some things better in England, and one of the things that we do better is interior lighting. But when we are pluming ourselves upon our superiority in illumination let us not forget that all of our recent improved light-sources, both gas and electric, originated in Europe.

FIG. 1.—A REPRODUCTION OF A COVER DESIGN TAKEN FROM AN ENGLISH ELECTRIC LIGHTING BULLETIN.

Fixtures and Accessories

Inexpensive Art in Fixtures

Those who possess wealth can have art: they can buy the virtue if they possess it not. But the wealthy are always in the minority, and if we are to fulfill the theory of the greatest good to the greatest number we must provide that the majority be able to secure art at a cost within their reach, which means a comparatively low one. There is no need to worry about the furnishing of the mansion; it is easy enough for the lord of the manor to take care of that. But what of the thousands of modest cottages that exist for every mansion? Shall they be left destitute of "sweetness and light"? Not surely because of the expensiveness of art; for true art, like true religion, can be had "without money and without price." To be sure, artistic lighting fixtures are not

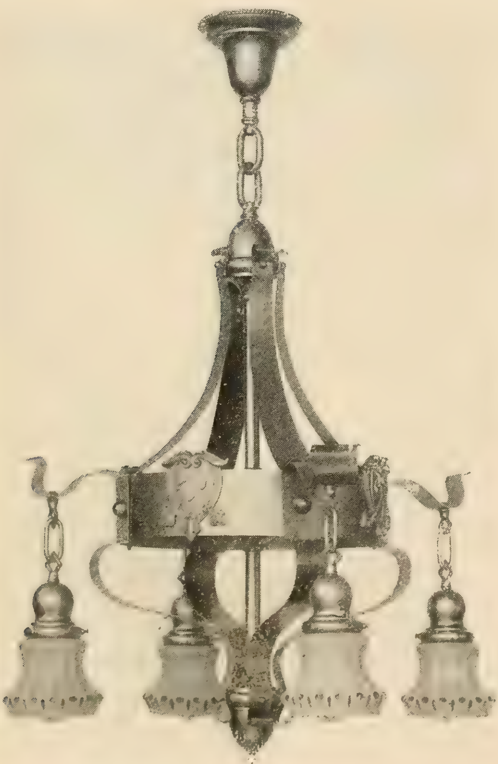


FIG. 1.

FIG. 2.

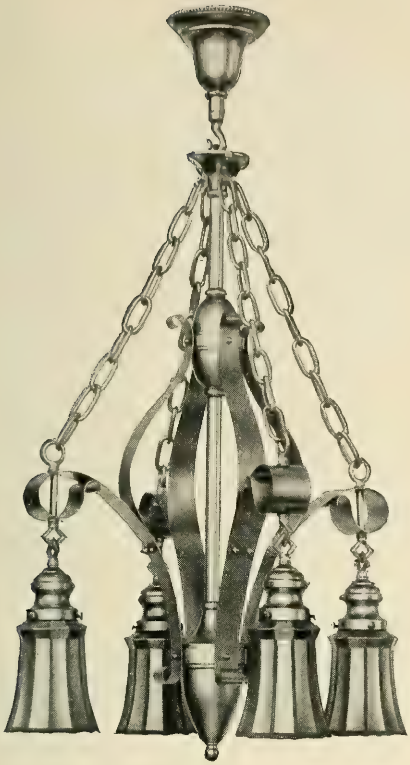


FIG. 3.

to be had for the asking; unlike the lavish summer, a price is set upon them. But even church pews have to be rented and preachers paid for their sermons. The point is this: lighting fixtures of some sort you must have, and at some price; there is no reason why that price should not secure a just return of good art. A thing does not necessarily have to be ugly because it is moderate in cost.

Back in the Middle Ages of American art, say, about the '70s, the chandelier was a product of the iron foundry; the arms were of channel construction, the channels opening upward, and being above the line of vision, passing for solid bars. Reaction from this cast iron age brought in the use of small brass tubes, ostensibly ornamented with flimsy sheet metal stampings. As the natural tendency to extremes subsided, tubing more visibly adequate to its purpose and bronze or brass castings decently engraved and finished, came into use and are found in all the better specimens at the present time. Meanwhile, a new light-source having not even a family resemblance to the old gas and oil flames, has come into almost universal use, and so the time is propitious for another stage of development in this branch of applied art. The use of chains for support in place of solid tubes or channels is an effort to adapt art to the new physical conditions.

The latest variation from old ideas which has come to our notice is the use of bands of metal for both decorative and practical construction. One of the chief results of this method is the production of a fixture that has really graceful and artistic lines at a price so modest that it might properly be called "the cottage fixture." Fig. 1 is a design of this type. The motive in the sweep of its curves suggests Art Nouveau. The composition is excellent, the bands of metal serving as visible supports for the light-sources, for which they have adequate but not mani-

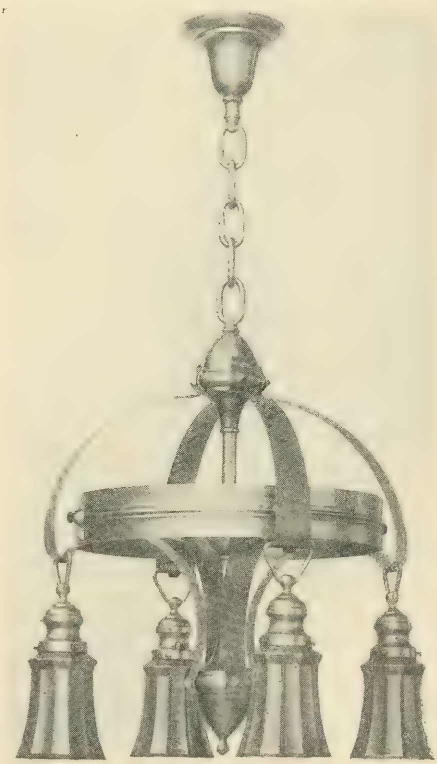


FIG. 4.

festly excessive strength. The spread of the fixture is 17 in., and the standard finish, brushed brass.

Fig. 2 is a combination of metal scrolls with jointed arms, the scrolls serving as supporters to hold the lamps apart. The spread of the fixture is 16 in. It shows a very successful combination of the more rigid and severe jointed arms, with the flowing curves of the scrolls.

Fig. 3 shows still another combination in which chains furnish the support to the lamps, the metal scrolls again serving only as spreaders. The spread of the fixture is 16 in.

Fig. 4 uses a metal band as a central support, which is strengthened by the scrolls. This is a slightly larger fixture, the spread being 20 in. The lines are more distinctly Art Nouveau.

In Fig. 5 use is made of the central bowl in connection with the separate lamps around its circumference. The glassware, as in the other examples, is a

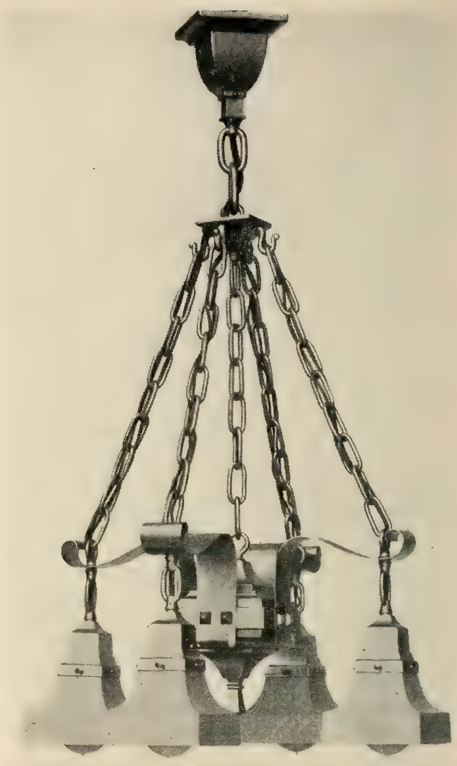


FIG. 6.

distinct element in the design, conforming to the general simplicity and harmony of the curves. The spread of the fixture is 16 in.

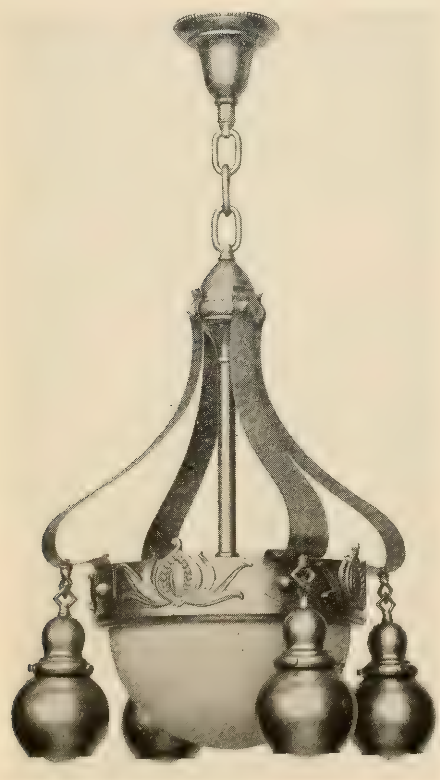


FIG. 5.

Fig. 6 is still another variation, introducing the angular motive in the square center piece and shades. The combination of angles and curves is carried out with rare skill. The spread of the fixture is 15 in.

Fig. 7 is another combination of angular construction with curves, and is an unusual example of distinctly artistic effect with marked simplicity of design and construction. The fixture has a spread of 12 in.

Fig. 8 is of a more severe and rugged effect, the twist in the supporting arms giving the effect of greater strength. The spread of the fixture is 15 in.

In all the designs shown there is admirable harmony in all the elements used; and while there is sufficient elaboration to give a feeling of art, there is an entire

FIG. 7.

freedom from the evident efforts to be decorative that so soon pall upon the sight. It is hard to conceive that fixtures of such motive should ever look " out of style," or passé, so long as they are in their proper environment, which is the cottage, the bungalow or the modest dwelling.

The variety in design and finish, the practical utility as illuminating units and the moderate cost of this admirable series of fixtures should exert a stimulating influence on both householders and fixture dealers to introduce more artistic, as well as more efficient lighting into the thousands of homes that were built and equipped a decade or more ago. While some of the expensive lighting fixtures of half a century or more ago were really fine pieces and worthy of being preserved, if not imitated, the ordinary fixture of a generation ago is a relic of crudity and garishness. We passed through an era of ginger-bread art, both in architecture and decoration, at about that time and the sooner all vestiges of its remains are removed, the less our æsthetic sense will be offended.

A lighting fixture is almost as prominent a feature in a room as " the nose on a man's face," and the extent to which even a slight defect in this organ can mar an otherwise comely face is proverbially apparent. Now that we have finally emerged from our dark age of art it is well that we should promote the tendency to better taste by setting the example of our own patronage.

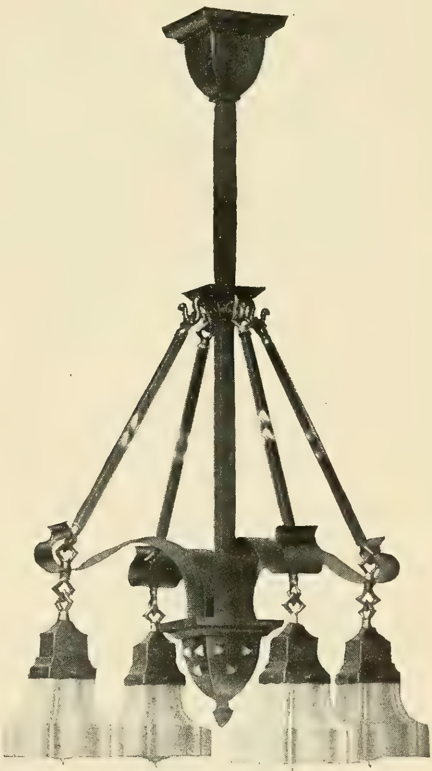


FIG. 8.

Plastic Art in Lighting Fixtures

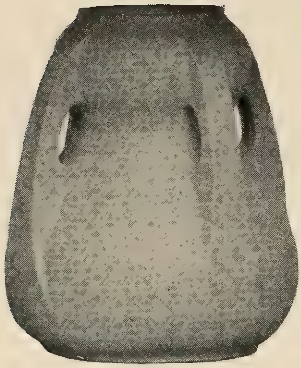


FIG. 1.

A lighting fixture is a mechanical device for supporting a light-source in such a position that the light may be advantageously used for producing illumination. There is absolutely no escaping this mechanical basis. Even the slaves who used to hold torches in the glorious days of ancient Greece and Rome obeyed the elemental laws of mechanics. Art in a lighting fixture does not consist in either concealing or eliminating the necessary mechanical structure, but rather in accentuating the principles of statics and clothing them in pleasing forms.

To be analytical, we may say that the light-source can be supported from above, from the side, or from below. In the first class we have the infinite variety of chandeliers, placques, and lanterns. The second class gives the side bracket or "sconce," while the last class gives the lamp and candelabrum.

FIG. 2.

The first task of the mechanic is the choice of materials. For supporting a weight from above tensile strength is necessary; hence the large and growing use of chains in the design of modern chandeliers. While the chains do not always actually support the weight of the light-source and its accessories, it satisfies the mechanical instinct by affording an

FIG. 3.

ostensible means of support that is always associated with a pulling force, of which the suspension of a weight is one case.

Support from the side requires rigidity, with a certain degree of tensile strength; hence the side bracket is constructed of metal, which possesses both of these qualities.

The weight that is supported from below exerts a crushing force, and therefore materials which lack both rigidity and toughness and tensile strength, may be properly used; as is seen in the use of stone and brick for foundation work and similar purposes.

The use of the most common of plastic substances, clay, for the support of light-sources from below, therefore, follows the strict laws of mechanics. A lamp may as properly rest upon a basis of baked clay as a building or column; and besides furnishing the mechanical support the clay may be fashioned into any form to please the esthetic sense.

Plastic art has many claims. First, it has historical association, being descended in a direct line from the earliest efforts of man to express his highest feelings in a permanent physical symbol: the oldest vestiges of art are found in pottery. The working of a shapeless mass of earth into

FIG. 5.

FIG. 4.

a form that typefies or resembles either the beauties of nature or the fancies of the imagination involves such infinite possibilities as to suggest the work of the Deity itself.

This symbolism of the potter's art as expressing the molding of human character is most effectively brought out in the familiar quatrains of Omar Khayyam, which will bear repetition though for the thousandth time:

For I remember stopping by the way,
To watch a Potter thumping his wet Clay:
And with its all-obliterated Tongue
It murmur'd: "Gently, Brother, gently, pray!"

And has not such a story of Old
Down Man's successive generations roll'd
Of such a clod of saturated Earth,
Cast by the Maker into Human mold?

* * * * * *

As under cover of departing Day,
Slunk hunger-stricken Ramazan away,
Once more within the Potter's house alone
I stood, surrounded by the Shapes of Clay.

Shapes of all Sorts and Sizes, great and small,
That stood along the floor and by the wall;
And some loquacious vessels were; and some
Listen'd perhaps, but never talk'd at all.

Said one among them: "Surely not in vain
My substance of the common Earth was ta'en
And to this Figure molded, to be broke,
Or trampled back to shapeless Earth again."

Then said a Second: "Ne'er a peevish Boy
Would break the Bowl from which he drank in joy;

FIG. 6.

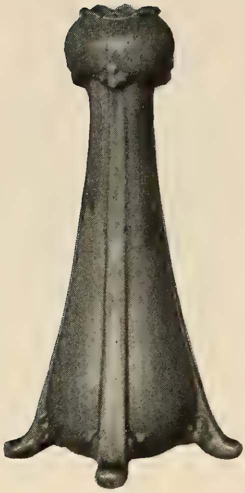


FIG. 7.

And he that with his hand the Vessel made,
Will surely not in after Wrath destroy.

After a momentary silence spake,
Some vessel of a more ungainly make;
"They sneer at me for leaning all awry:
What! did the Hand then of the Potter
shake?"

Whereat some one of the loquacious Lot—
I think a Sufi pipkin—waxing hot—
"All this of Pot and Potter—tell me then,
Who is the Potter, pray, and who the pot?"

"Why," said another, "Some there are who
tell
Of one who threatens he will toss to Hell
The luckless Pots he marr'd in making—
Pish!
He's a Good Fellow, and 'twill all be well."

"Well," murmur'd one, "Let whoso make
or buy,
My Clay with long Oblivion is gone dry;
But fill me with the old familiar Juice,
Methinks I might recover by and by."

Another source of attractiveness in pottery is the mark of the individual, human touch which it bears. It does not smack of the spinning lathe, the stamping press, or the foundry. While machinery may have been called to the aid of the artisan to a certain extent, it has not so aggressively left its stamp upon the final product as in many other cases of handicraft. The piece of art pottery is decidedly more nearly the work of one person than most articles of commerce.

Since the hanging light-source and the side bracket are logically made of metal, the natural love of variety offers still another reason for the use of pottery for lamps which are light-sources supported from beneath.

America has produced a number of distinct and beautiful forms of pottery, and any of these types are available for the supporting parts or bases of lamps. The illustrations show a few forms of a beautiful and distinctive pottery that has been developed in what New Yorkers call "the West," *i.e.,* in the vicinity of Chicago.

Since modern light-sources require a shade to properly direct their light and to screen the eyes, and as these shades must be comparatively large in order to give a full field of illumination, it follows that a lamp base must have a corresponding degree of stability. Forms should therefore be chosen which have a fairly large "base," mechanically speaking, otherwise the lamp will appear "top-heavy." The patterns shown all fulfill this condition to the necessary degree; although, of course, the more slender types should be fitted with smaller shades.

FIG. 8.

The artistic effect of this ware is due to its individuality in form and color, the latter being of a shade of green closely resembling the much admired verte bronze. These forms are adaptable to either gas or electric lamps, and will harmonize with either the leaded art glass or silk shades. They possess the double virtue of beauty and utility, for nothing could be more serviceable, or better suited to the purpose. The few forms illustrated show the possibilities in artistic expression.

Is Illuminating Engineering a Distinct Branch of Applied Science?

When the first efforts were being made to organize an illuminating engineering society the most serious question put was the one above stated; and the same query was propounded to the editor of this publication. Artificial lighting had been done for time out of mind—why should it suddenly require the undivided attention of a new and distinct class of scientists? Those who gave a second thought to the inquiry were of the opinion that such study of the subject as might be demanded properly belonged to the various scientific bodies already in existence, a view which was at once accepted by the members of these bodies themselves. The American Institute of Electrical Engineers particularly claimed illumination as its bailiwick, one of the founders and prominent members stating that "he could see no more reason for an association of illuminating engineers than for an association of armature winders," an opinion which showed either an exalted view of the science and art of armature winding or a slight conception of the importance of the science and art of illumination.

The history of the development of illuminating engineering as a science and profession, however, is by no means an exceptional record, nor do the events cast any unusual reflections upon those concerned; it is simply a case of the usual operation of the human mind under existing conditions. We all of us magnify the importance of our own vocations, and belittle the need of others in proportion to our ignorance of them.

Now that illuminating engineering is thoroughly established and accepted, it may be of passing interest to review the work of associations that, with more or less plausibility, claimed the subject as a "side line" of their own, and see what attention has been given to it.

The Illuminating Engineering Society was definitely organized in February, 1906. Since that time the American Institute of Electrical Engineers has had nine papers presented at its meetings and conventions dealing with subjects pertaining to illumination, as follows:

1906—"Notes on the Lighting of Churches," by Edwin R. Weeks.

1906—"Transformation of Electric Power Into Light," by Dr. Charles P. Steinmetz.

1906—"New Types of Incandescent Lamps," by Dr. Clayton H. Sharp.

1907—"Light from Gaseous Conductors in Glass Tubes—The Moore Light," by D. MacFarlan Moore.

1908—"Primary Standard of Light," by Dr. Charles P. Steinmetz.

1910—"Metal Filament Lamps," by John W. Howell.

1910—"Some Developments of Modern Lighting Systems," by C. W. Stone.

1910—"Carbon Filament Lamps as Photometric Standards," by E. B. Rosa and G. W. Middlekauf.

1910—"Tungsten Lamps," by George S. Merrill.

The American Gas Institute, since its organization in 1907, has had five papers, as follows:

1906—"The Standardization of Incandescent Gas Mantles," by Van Rensselaer Lansingh.

1908—"Better Gas Illumination," by T. J. Little, Jr.

1909—"The Relation of Natural Science to the Development of Lighting," by Dr. E. P. Hyde.

1909—"Practical Applications of Illuminating Engineering," by Norman Macbeth.

1910—"The Lighting and Ventilation of Gas Appliance Display Rooms," by Thomas Scofield.

Of the A. I. E. E. papers but one—that on the lighting of churches—deals with illumination, the others dealing with the technology of the production and measurement of light, and only have a bearing on the theoretical side of illuminating engineering.

Four of the five American Gas Institute papers deal practically with illuminating engineering subjects, but it must be remembered that this association was founded after the establishment of the Illuminating Engineering Society, and that the necessity of recognizing this subject was doubtless due to this fact.

This record alone proves conclusively the claims of illuminating engineering to the rank of a separate profession and science, for either the subjects with which it deals were not considered sufficiently important to be treated in the older organizations, or members of the older organizations who had papers to present on such subjects preferred to submit them to the Illuminating Engineering Society as the proper channel for publicity. Either view of the case proves our contention.

A survey of the *Transactions* of the Ophthalmological Associations will show a corresponding lack of treatment of the subject. Various commercial organizations, such as the National Electric Light Association, the National Commercial Gas Association, and the National Electrical Contractors' Association, have, it is true, given considerable attention to the subject of illuminating engineering; but it is sufficiently evident that the treatment of the subject from the commercial standpoint could never develop a science or art. They have considered it by force of circumstances, just as they have considered the agitation for municipal ownership and public service commissions. Illuminating engineering became a factor to be reckoned with and was so treated.

Since its organization the Illuminating Engineering Society has published 4468 pages of *Proceedings,* including 200 papers on every phase of the subject. This is exclusive of the Johns Hopkins lectures, which in themselves cover the entire subject and constitute two volumes aggregating 1,052 pages. The record certainly justifies the claims and more than fulfills the hopes of the founders of illuminating engineering.

Standard Specifications for Street Lighting

This important subject, which has been under consideration by a special committee of the National Electric Light Association in this country for a number of years past, has recently come into special prominence in England. *The Illuminating Engineer,* (London), has conducted a symposium on the subject which is reported in the current July issue. A carefully prepared list of questions involving the chief points at issue was sent to various authorities in both gas and electric lighting in England, America and on the Continent. The following is a copy of the questions:—

"1. Ought the specification to contain a statement of: (*a*) The electrical energy or gas to be consumed; or (*b*) the amount of light provided; or (*c*) both energy or gas consumed and amount of light?

"2. Should the amount of light supplied be specified in terms of (*a*) the provision of a certain actual minimum illumination in the street; or (*b*) the provision of lamps of a certified candle-power?

"3. If illumination is to be measured, should this measurement be carried out (*a*) in a horizontal plane at a stated height above the ground; or (*b*) in a vertical plane; or (*c*) in some other inclined plane such as 45 degrees? (*d*) Should both the mean and the minimum street illumination be measured and specified?

"4. If candle-power is to be tested in the street should (*a*) the mean spherical or mean hemispherical candle-power, or (*b*) the candle-power in several specified directions be tested?

"5. Should the contract demand (*a*) actual measurements in the streets or (*b*) only laboratory tests of the competing lamps previous to the acceptance of a tender, or (*c*) preliminary laboratory tests supplemented by periodical tests of the actual lighting conditions when the lamp is in position?

"6. Should any test of the constancy of the candle-power of the lamps be prescribed?

"7. Do you advocate the introduction of any stipulation regarding the efficient shading of lamps, height above ground, etc., with a view to the avoidance of glare, such as is recognized to be dangerous and inconvenient to traffic and pedestrians?

"8. Should any specific color of the light be prescribed? If so, how should this be tested?

"9. What other clauses would you suggest being inserted?"

The American authorities replying are Dr. Louis Bell and Mr. Preston S. Millar. The Continental authorities are Dr. L. Bloch, Dr. H. Drehschmidt and Herr Max Scholz, of Berlin; Dr. H. Bunte and Prof. J. Teichmuller, of Karlsruhe; Dr. W. Voege and Dr. H. Kruss, of Hamburg; Dr. B. Monasch, of Augsburg; Herr J. Herzog, Budapest; Herr K. Satori, of Vienna, and Prof. S. A. Rumi, of Genoa.

With all due respect to the opinions of the Continental authorities, our own Dr. Bell appears to have contributed the most logical and clear discussion of the several questions.

A poll of the opinions may be of interest.

To question 1 (*a*) there are 1 affirmative, 2 negative; (*b*) 3 negative; (*c*) 7 affirmative, 1 negative (conditionally).

2—(*a*) 6 affirmative, 3 negative; (*b*) 2 affirmative, 4 negative.

3—(*a*) 9 affirmative, 1 negative; (*b*) 3 affirmative, 3 negative; (*c*) 3 negative, no affirmative.

4—(*a*) 2 negative, 3 m. h. c. p.; (*b*) 2 affirmative, 1 negative.

5—(*a*) 2 negative, 1 affirmative; (*b*) 3 affirmative; (*c*) 6 affirmative, 2 negative.

6—2 affirmative, 5 negative.

7—3 affirmative, 3 negative.

8—7 negative, 1 affirmative.

It will be seen that there is practical unanimity of opinion on the most important question; that is, as to whether street lighting contract should be based upon the illumination produced, the illuminant consumed, or both; the opinion being that both should be specified. On all other questions there is lack of agreement. The general verdict then is that we are not yet in a position to buy or sell illumination as such, but must still depend upon the consumption of illumination as the chief basis of money values, at least in the case of exterior lighting.

It does not follow from this verdict, however, that no progress has been made toward the theoretical basis of estimating values. The opinion expressed is that the question of amount of light, or illumination, should be considered equally with that of the amount of illuminant used, or the amount of apparatus installed. This is very measurable progress from the method of buying street lighting by simply specifying the kind of lamp, and this often erroneously rates, as for example, the 2000 candle power arc, or the 60 candle power gas mantle. The street lighting contract drawn in accordance with the consensus of opinion expressed in this case would give very little opportunity indeed for either the party furnishing the illumination to give less than the consumer expects, or for the consumer to demand more than he rightfully purchased.

Better Light in the Country

It used to be said that "God made the country and man made the town," which was true enough as sayings go; and science has been poetically defined as "thinking again the thoughts of God." As a result of pursuing this mode of thought man has set about remaking the country so as to better fit it for his abode. The time-worn gibes of the city dweller anent the crudities and discomforts incident to rural life have already lost most of their point. In fact, the countryman may well turn the tables on his erstwhile detractor, and as he spins along in his automobile through the leafy country roads on his return from market, with a comfortable roll of Uncle Sam's promises to pay in his pocket and alights at the door of his roomy home just as the gas is being lit in the dining-room (acetylene or naphtha gas as he prefers), he may well feel disposed to call up his city counsin on the telephone and ask him how he manages to get through these hot nights in his stuffy little apartment.

The romantic days of the light of the pine knot or the blazing log in the fireplace, immortalized by some of the noblest characters this country has ever produced,

or is likely to produce, have passed. Likewise the greasy days—or nights—of the tallow candle, and the smoky, smelly days of the kerosene lamp are passing. There is now, in fact, not one physical comfort enjoyed by the city dweller that is not reasonably within reach of the country inhabitant. The only remaining difference between country and city is the relative proximity of people, and this is an advantage which must be decided by the individual.

There is no more need at present of the countryman depending upon common lamps or candles for his illumination than upon the rain water barrel for his water supply; they are all evidences of poverty or penuriousness, and these are not incidental to country life, but to the present imperfect condition of human nature. A modern acetylene or gasoline gas plant for a country house by no means involves a prohibitive cost; on the contrary, it necessitates only a comparatively small investment upon which the actual returns by way of economy represent ample dividends. Nor are such installations more difficult of operation than the lamps they displace; they simply change the work from the female to the male contingent of the household, which may probably be considered an advance step in itself.

The use of the facilities of modern science, among which none is more marked than methods of producing light, is both a cause and an effect of a higher plane of civilization in the country. The importance of this to the people cannot be overestimated, for it is an undisputed fact that the country is the life of a nation in both the physical and moral sense. Better conditions of living will hold and attract a higher type of manhood and womanhood in the rural sections, while conversely this higher life will react to produce still better conditions.

The extension of electricity, with all the advantage which it carries, into the country districts is only beginning, and is destined to make extensive and rapid progress in the immediate future. It may seem but a platitude to repeat the close connection between moral and physical light, but it exists nevertheless, and the adoption of modern means of illumination in the country will be a distinct force for moral uplift, which will afford at least one compensating factor for the admitted decline in the influence of the present-day preacher. The country boy, if he hears less moralizing from the pulpit, has the opportunity and the means, thanks largely to modern illumination, during the evening when he is at leisure, for reading the works of the great masters of thought of all ages.

A Correspondence Course In Gas Salesmanship

The first lesson in this course, which was announced in a previous issue, has just been issued by the National Commercial Gas Association under the title "The Real Salesman and the Near Salesman." This lesson is intended as a general introduction to the course, and therefore deals with generalities. A series of ten questions is given at the close.

Education by correspondence has become a subject furnishing no little material for the jokesmiths, and undoubtedly, like all other good things, the correspondenc system has been more or less utilized by the unscrupulous as a means of separating the ambitious and the guileless from their coin.

There has also been no little alleged witticism expended upon the presumed folly of attempting to make a man a salesman by training; it is so easy to quote the plagarism, "salesmen are born, not made." Being born is undoubtedly a rather essential beginning to any career, but all this talk about such and such a calling being "born in a man" is nine-tenths specious nonsense. The great geniuses of the world were so by birth, it is true, but they are few and far between; the nation that gets one in a generation is lucky. The rest of us must be content to *learn* what we are good for and how to make good.

Salesmanship is a craft, and as such must be learned like any other trade. Some will become better workmen than others, but none are exempt from the apprenticeship stage.

It is the purpose of this course to shorten the apprenticeship by a more direct and systematic method of instruction than that which obtains in learning by the old-time method of jumping at once into the work. There is a saying among peda-

gogues that "experience is a dear teacher, but fools learn of no other." Such a course as is outlined should materially cheapen the instruction of this proverbially dear but invaluable instructor, for the experience of a number of the leading experts in gas salesmanship is being utilized in the formation of the lessons.

The first lesson is remarkably clear and free from the platitudes and high sounding theories which too often enter into discourses on salesmanship. If this is to be taken as an earnest of what is to come, which is a fair assumption, the course will be decidedly practical and beneficial. Some four hundred and twenty-five students have already subscribed to the course, with more to come. Its effect upon the general plane of handling business in the gas industry should be distinctly felt. It is a good thing, and we are glad to note is being so recognized by the gas interests.

Letters

EDITOR, THE ILLUMINATING ENGINEER,
NEW YORK, N. Y.:

In your June, 1911, issue appears the second part of the timely article of Mr. S. G. Hibben on "The Photometry of Colored Light-Sources."

Much credit is due Mr. Hibben for the time and patience which he has exercised in investigating the subject pertaining to the accuracy of the flicker photometer. The writer has read with much interest both communications which have appeared so far, and while it would, no doubt, be desirable to wait until the article is completed before discussing it, the writer is still taking the liberty of making a few suggestions at this time in the hope that Mr. Hibben may have an opportunity to incorporate in his final article the results of the suggestions herewith.

Referring to Fig. 6, Mr. Hibben presents curves for two observers, which show the white to white comparison. In commenting upon these curves, Mr. Hibben states: "As a primary basis for comparison a test was made between two white lights, which would be expected to give a horizontal straight line of plotted results; in fact, the curve is as near this as could be hoped, and does not show any more than a probable error. One remarkable result as seen from all these curves is the difference in values obtained by all these observers."

In these curves the average difference at 100 c.m. is about 3 per cent., which, considering the low intensity of the light on the photometer screen at which comparison was made, seems to the writer to be quite satisfactory, especially when we consider 4 c.-p. was used as standard, while the colored lamp in some cases was 300 c.m. from the photometer screen.

Coming to curve 7, where a comparison is made between a white and a blue lamp, the statement is made that the blue lamp is rated at 16 c.-p. This method of rating has undoubtedly been established in the past to indicate that a 16 c.-p. filament was placed inside of a blue globe, and if the globe were clear glass it would emit 16 horizontal candle-power. The actual intensity of this lamp, however, is very low, and, as Mr. Hibben has indicated in his curves, at the distance of 100 c.m., the average values of the two observers is about 1-14 of the 4 c.-p. lamp, or .286 c.-p. At this same distance of 100 c.m., which is the nearest distance to the photometer screen which Mr. Hibben uses, the intensity is .00263 foot candles. Where we come to a distance of 200 c.m. it can readily be observed that the intensity would be much lower still.

It is extremely difficult to make comparison between like colored illuminants at this intensity with any degree of accuracy, and when it comes to comparing lights which differ in color, the source of error which is liable to be introduced, due to the purkinje effect, irrespective of what type of photometer is used, is simply enormous. While it is true that with the flicker photometer, as has been shown by Dow in the *Electrical World* of February 24, 1910, the error due to the purkinje effect is much less than with the direct comparison photometer, still it could not help but be realized that the possibility of obtaining accurate measurements at these low intensities, even with the flicker photometer, is quite small. In fact, in the writer's mind the closeness of the agreement of A and B's values, when we con-

sider all of the conditions is quite remarkable.

To give some idea of the magnitude of the error which the purkinje effect produces, I would state that the writer is aware of a test which was made on a mercury vapor tube, which was photometered with the ordinary direct comparison photometer at a distance of 50 ft. from the light-source, and then at a distance of 15 ft. a small sized mercury vapor tube being used. It was found that at 50 ft. a value of 30 per cent. in excess of the measured value of 15 ft. was observed. While the intensities on the photometer screen in this case with this direct comparison photometer were much higher than those which Mr. Hibben used, still it is realized how liable to error the purkinje effect is apt to lead us.

Mr. Hibben realizes this source of error on page 227, where he says: "Again the results lead to the conclusion that the purkinje effects are pronounced and must be considered in such work."

In ordinary photometric work where accuracy is desired we attempt not to go below an intensity of 1 foot candle on the photometer screen. It is realized that there are times when it is necessary in order to test some illuminants such as arc lamps installed in street service, to work with very low intensities. In this case it is necessary to use the greatest possible care in order to obtain results which are at all satisfactory.

If Mr. Hibben has time before submitting his final article, the writer suggests that the photometer lamps of much higher intensity than those used where fairly high intensities on photometer screen can be obtained, as the writer has found by experience under normal working conditions that the purkinje effect would be practically eliminated and that very accurate results can be obtained with the flicker photometer.

In closing the writer realizes the difficulties which are encountered in carrying on the research which Mr. Hibben has outlined, and of the necessity oftentimes of using materials which are at hand. If it were possible, however, for Mr. Hibben to obtain these results as suggested it would add very materially to the literature which has already been published on this subject.

Very truly yours,

Sydney W. Ashe.

The Editor, The Illuminating Engineer:

The able editorial in your July issue on competitive illuminants is a much more truthful statement of the relative merits of gas versus electricity than probably could have been expected of the members *signing* the N. E. L. A. Report. There are some of your impartial observations which should be emphasized in the hope that the gas fraternity will see the handwriting on the wall and heed your parting injunction to be doing instead of talking. (They are too far outclassed in the latter form of competition to start their entry.)

The fact that gas is used to a larger extent for lighting than any illuminant should at least prove that it has many advantages. These are due, however, to the mechanical ingenuity of the manufacturers of gas and of gas lighting apparatus. The engineering skill in the utilization of the appliances has in the majority of instances been left to the householder.

Light diffusing and directing globes, shades and reflectors which produce the æsthetic and utilitarian effects which constitute good illumination are in most instances selected by the housewife or the storekeeper with the aid of the department store clerk or perhaps the peddler rather than in the showrooms of the great utility corporations with the aid of trained employees.

The æsthetic features can perhaps be best handled by the housewife, but when the physiological aspects are considered training and experience are requisite to determine the kind and quantity of light which is required to enable us to pursue our work and play under artificial light without ill effect upon our eyes.

If gas lighting is to survive and prosper illuminating engineering must receive a much larger share of attention than has been accorded it in the past.

Very truly yours,

H. Thurston Owens.

Notes and Comments

The Progress of Better Public Lighting Takes No Summer Vacation

MINNEAPOLIS CELEBRATES TURNING ON OF NEW STREET LIGHTS

IMPOSING CEREMONIES OCCUPYING THE ENTIRE EVENING PROVIDED.

Minneapolis, probably next to Los Angeles, may be considered the leader of decorative street lighting in this country, and has achieved a large and well merited amount of general praise and publicity for the magnificent installations which it possesses. A new addition to its already extensive system was recently celebrated in an elaborate and enthusiastic manner, as will be seen by the following extracts from the description of the programme appearing in the *Journal:*

"'A Blaze of Light' is the name the North Siders have given to the event of Friday, when at 8.30 p.m., the new ornamental electric street lamps on Twentieth avenue N from Washington to Dupont avenue, are to be lighted for the first time. At a signal the lights will be turned on one by one until they have zigzagged from one end of the row to the other.

"Thirty thousand people are expected to turn out to see the lights turned on and the parade which is to follow. Nearly 2000 men and hundreds of automobiles will be in line for the parade.

"Much money has been spent preparing for the decorations of the buildings along the line of march, and the avenue is to have a celebration appearance. The affair is set for Friday, so that everything will be in working order when the civic celebration opens the following week.

"The celebration of the turning on of the lights will end with a big carnival in the North Side amusement park at Twenty-first avenue N and Third street. Vaudeville, moving pictures and side shows will give plenty of entertainment. A percentage of the receipts will go to the street lighting fund Friday and Saturday nights.

"Having placed the avenue on a metropolitan basis with its paving, fine stores facing the street, its car lines and ornamental lamps, the club members are not going to fall behind the present record in the parade. It is to be the greatest event in the history of that part of the city. State, city and county officials are to take part, all the North Side fraternal organizations, Company A, First Regiment, M. N. G., the police and fire departments. Three bands will play.

CHICAGO TO BE THE "BEST LIGHTED CITY"

AT LEAST MAYOR CARTER HARRISON SAYS SO.

The city in these days that is not "the best lighted city of its size in the world" is not worth a place on the map. In a recent issue we chronicled the official statement (at least it emanated from city officials) that Philadelphia was, or was shortly to be, the real sure-enough "best lighted city"; and following close on the heels of this pronunciamento came a voice from Chicago bidding the Quakers to take a back seat on the lighting question, and declaring that the windy metropolis was turning its sewage into light, and when this luminous flood was poured over the city it would surpass any other efforts of public lighting as Noah's flood surpasses a thunder shower. Those who remember the Chicago River in the ante-drainage canal days would readily believe in the superiority of Chicago lighting, providing there were reasonable efficiency in the conversion of the sewage into light.

Mayor Harrison, however, preserves a discreet modesty in his proclamation, putting in the saving words "one of" in his claims for the best lighted city, according to an interview in the *Journal:*

"Chicago will be one of the best lighted cities in the world when we get through with plans which are now under way for making the downtown section loom up like a blazing torch," said Mayor Harrison to-day, as he examined designs for ornamental stands to support the big clusters of flaming arcs which are soon to surround City Hall Square.

"I have always held that anything done to develop the esthetic side of Chicago is a direct commercial assistance to the city. Our streets have been poorly lighted for years. But with intelligent co-operation with the drainage board I expect great improvement to be made at once.

"We are going to start in by lighting up the block around the City Hall. Ornate lamp-posts with clusters of powerful arc lamps will be installed as a sort of object lesson to the rest of the city. The improved lighting should not be confined to the business section, but will be extended to the out-

lying sections, until Chicago will be known as the world's most brilliantly lighted city."

PHILADELPHIA NOW WANTS ARC LAMPS IN PAIRS

MAYOR BELIEVES TWO LIGHTS ARE BETTER THAN ONE.

If Philadelphia keeps up the pace in its campaign for more and better light it is only a question of time when it will, without a shadow of doubt or darkness be, in fact, the best lighted city in the universe. A day which passes without some new proposition to extend its street lighting is considered a day lost. Mayor Reyburn, who has been the proud father of the movement, now wants his luminous progeny in the form of twins, according to the *Public Ledger:*

"Mayor Reyburn will send a message to Councils again urging action on a bill providing for the erection of twin arc lights like those in the center of the city on principal business thoroughfares and squares in various parts of the city.

"The Mayor had a further conference on the subject yesterday with Chief McLaughlin, of the Electrical Bureau, who has prepared plans and estimates for the new lighting showing that the cost will be about $25,000, for which the ordinance in Councils provides."

ELECTRIC LIGHT TO BE CHEAPER IN CLEVELAND

CITY OF THREE-CENT FARES TO SAVE $100,000 A YEAR ON ITS LIGHTING BILLS.

The fact that the two great illuminants, gas and electricity, have grown continually cheaper in the face of generally advancing prices of other commodities is again exemplified in Cleveland, where a substantial reduction in the rates for electric current have been voluntarily made by the local central station, according to the *News:*

"One hundred thousand dollars, it is estimated, will be saved to the home users of electricity for illumination by a reduction in rate which was put into effect June 30 by the Cleveland Electric Illuminating Company. A still further saving will be made possible for the users of electric power by a new schedule of rates which is now being worked out and which will be announced later.

"Four months were occupied by the company in preparing the new rates. The new schedule is on file according to law in the office of the public utilities commission, which was created under the new utilities act.

"The domestic rate for illumination formerly was 12½ cents per kilowat hour or unit for the minimum number of units fixed by the company for each house after it was wired, and 5 cents for each unit over the minimum."

GAS VERSUS ELECTRICITY FOR STREET LIGHTING

THE QUESTION BEING STRENUOUSLY DISCUSSED IN TONAWANDA, N. Y.

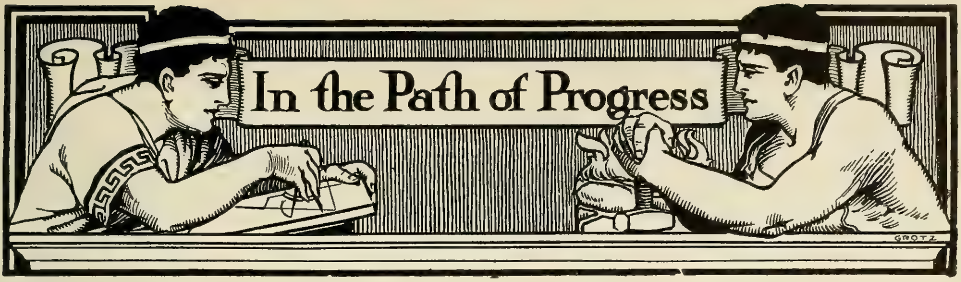
According to special correspondence in the Buffalo *Courier* it would seem that the company supplying Niagara Falls electric current is very anxious to use gas for street illumination:

"The Niagara Light, Heat & Power Company of this city is waging a strenuous fight in an effort to induce the cities of North Tonawanda and Tonawanda to use gas for street lighting on the residential thoroughfares. The matter is already attracting so much attention that the proposition promises to be given a thorough hearing in the near future by the Common Councils of both cities."

RAILWAY COMPANY CORDIALLY INDORSES DECORATIVE STREET LIGHTING

SUBSCRIBES TO THE MERCHANTS' FUND IN ELIZABETH, N. J.

"Another out of town corporation has responded to the invitation of the Broad Street Improvement Association to join in the better lighting project. In a letter to Frank L. Devine, secretary of the Board of Trade, the Central Railroad Company agrees to pay the assessment on its property in Broad street. This is the third subscription from out of town companies which will be received at the meeting of the association."—*Courant.*



R. F. Pierce Becomes Manager of the Welsbach Illuminating Engineering Laboratories

ROBERT FFRENCH PIERCE.

The most successful American plays have been fully as much the creations of the actors as of the playwrights. While the latter furnished the ideas, or perhaps more properly speaking, the ideals, it was the former that embodied them in a flesh and blood reality. The theater is not the only institution that thus depends upon personality. In fact, there is no institution which is not similarly dependent upon individual genius. There was a time when students left Harvard to graduate at Union College, because they wanted the signature of Horace Mann on their diplomas. All the material advantages that money can purchase will not make a great university or college to-day; one professor of commanding personality will outweigh millions, so far as prestige and usefulness of the institution is concerned.

On the same general principle the creation of an illuminating engineering department in connection with a public institution or business concern is not accomplished by the purchase of laboratory apparatus and the printing of title names on a letter head, but by the personal qualities of the man in charge.

The Welsbach Company, Gloucester, N. J., is one of the largest manufacturers of gas lighting apparatus in the world, and overwhelmingly the largest in this country. It has both financial resources and prestige to back up any enterprise which it undertakes, and when it decided to establish a department of illuminating engineering it was to be expected that the undertaking would not be done by halves. It was easy enough to get the apparatus, but where was the man that could create an illuminating engineering department that should represent the science and profession of illuminating engineering to a degree commensurate with the interests involved?

The right man was found in the person of Norman Macbeth. While his unusual combination of qualifications for the position was recognized by those familiar with his work, it had not yet reached the public ear. Given the opportunity, however, genius very soon showed itself, and the illuminating engineering laboratories of the Welsbach Company became, in fact, what they were in name, and were recognized not only by the entire gas interests, but by their electric competitors as well.

It may be fairly said that the illuminating engineering laboratories of the Welsbach Company are the creation of Mr. Macbeth, working with the facilities and financial resources of the company, and, upon his retirement, he left an established institution with a name as well as a local habitation.

It is perhaps no less difficult to live up to the pace set by ability and initiative than to introduce it. The man who can carry on the work of the Welsbach laboratories without retrograding must be an illuminating engineer in reality. This task has fallen to Mr. R. F. Pierce, who has been known to our readers for some time as one of our most able contributors. Mr. Pierce is still young in years, being but thirty-two; but he is unusually old in experience. He is an American of English and Welsh descent; his full name, if written according to the Welsh language, being Robert ffrench Pierce. His native town is Blairstown, Iowa, where he received a high school education, and afterward engaged in the drug and chemical business with his father for seven years. He then entered Harvard University, from which he was graduated in 1905, having specialized in electrical engineering. After leaving college he engaged professionally with the General Electric Company, and later did engineering work in England. He also for a short time yielded to the spirit of adventure and essayed the rôle of a soldier of fortune on a semi-political expedition to Venezuela, which seems to have resulted in nothing more serious than "a personal acquaintance with maggoty beef and graybacks" —to use his own picturesque language. He was married in 1907 and has two young sons.

Mr. Pierce is at present an Associate Member of the American Institute of Electrical Engineers, a Member of the American Electrochemical Society, the Illuminating Engineering Society and a Charter Member of the American Association for the Conservation of Vision.

Mr. Pierce is an engineer in the broadest sense of the term, which implies that he combines technical knowledge, ability to observe and analyze, and practical constructive imagination. Both his work and his writing show that he is a man who goes to the bottom of things, and carefully distinguishes between the trivial and the important. While he is thoroughly aggressive, he is at the same time conservative; in other words, having fully analyzed his proposition and marked out his course, he pursues it with vigor and force. His manner is genial and pleasant, and leaves an impression of poise and reserve force. He is a particular, able writer on engineering subjects; his work being characterized by the strength and lucidity that come with mastery of both technical knowledge of the subject and of the English language.

There is every reason to believe that Mr. Pierce will continue the work so admirably begun, and carried to such success by his predecessor, with a degree of energy and ability that will reflect credit alike upon the company and himself.

A New Incandescent Kerosene Lamp

The masterly researches and discoveries of Dr. Auer von Welsbach, which revolutionized gas lighting, are undoubtedly destined to perform a similar service for petroleum lighting. An oil burning lamp designed to produce light by incandescence from a Welsbach mantle has recently come into our hands which, after two months of practical use, has demonstrated its complete practicability for general use. Without going into mechanical details other than to state that the construction is sufficiently simple and rugged to adapt it to operation by any reasonably intelligent user, it may be said that a tubular wick is used similar to the kind supplied for the larger flame lamps, but that the oil, instead of being burned with a luminous flame, is volatilized and the resulting vapor mixed with air so as to produce the regular Bunsen flame, which is used to heat a standard 3-in. Welsbach mantle to incandescence. The lamp will burn practically twice as long on a given quantity of oil as a flame lamp using the same sized wick, and gives several times as much light, the exact photometric measurement not being at our command. It follows

that, burning oil at but half the rate, it will give out but half as much heat as the flame light, which is a matter of no small consequence in such weather as we have been blessed with during the past month. While the lamp is designed for a common grade of kerosene, it is easily adaptable to gasoline or alcohol. As petroleum came to light just as the sperm whale was being exterminated (which was the former principal source of illuminating oil), so methods of producing an efficient light from alcohol are at hand for use whenever Nature's supply of petroleum may diminish. Alcohol being the product of vegetable growth can be had in inexhaustible supply.

The lamp is the invention of Mr. Charles Doorenbos, who was one of the first successful designers of the gas arc lamp. The new lamp, which is known as the Kero-Vapor lamp, is being manufactured and sold by Doorenbos Brothers, Kalamazoo, Mich.

An Improvement in the Mechanical Construction of Simple Lighting Units

There are three necessary elements in any lighting fixture, viz: mechanical construction, illuminating engineering design and decorative treatment.

Very much has been written and said about the last two elements mentioned, but the first has received less attention than its importance demands. Many a fixture that would be otherwise good is seriously handicapped by faulty mechanics. This is a particularly serious fault in fixtures for commercial use, where simplicity and adaptability to the requirements of maintenance are of special importance. Substantial improvements in the mechanical design of such fixtures are therefore as well worthy of attention as are improvements in the illuminating engineering design.

The introduction of the Mazda or tungsten lamp, which is used in much larger sizes than the carbon filament lamp which it is displacing, and consequently with filaments of different sizes and in different position, has necessitated radical changes in the construction of globe and reflector holders. The necessity for such changes have been still further enhanced by the large use of prismatic glass which, acting like a mirror reflector, requires a definite position with regard to the light source in order to produce the results for which it is calculated. The question of holders and sockets is therefore of no small moment.

A recent invention in this line by Mr. W. C. Hine of Cleveland, is well worthy of careful inspection by illuminating engineers and consumers. The following description of this device and its applications has been furnished by the Adams-Bagnall Electric Company, of Cleveland, which has the exclusive license for their manufacture in this country:

To obtain scientific illumination it has always been necessary to obtain proper rela-

FIG. 1.—CROSS SECTION, 2¼-IN. PENDANT ABOLITE, SHOWING POSITIONING DEVICE THROWN DOWNWARD TO GIVE "O" POSITION. THROWN UPWARD GIVES "H" POSITION.

FIG. 2.—3¼-IN. CEILING ABOLITE.

FIG. 3.—3¼-IN. PENDANT ABOLITE CAN BE SUSPENDED BY CORD, EXTENSION CASING OR CHAIN.

FIG. 4.—60-WATT BOWL ABOLITE.

FIG. 5.—250-WATT BOWL ABOLITE.

FIG. 6.—400 AND 500 WATT BOWL ABOLITE.

tion between lamp and reflecting surface. On account of different lengths of bases in Mazda lamps it has been necessary to attach several kinds of separable holders to a regulation Edison socket. The reflector in turn was suspended from the holder.

The primary construction characteristic of the Abolite is the provision of a metal support for a reflector to replace variable holders.

To this is applied the cardinal principle of a patented positioning device attached to a suitable porcelain receptacle. When the positioning yoke is thrown downward the lamps and reflector are in the position obtained by use of "O" holders. When thrown upward the "H" position is obtained. These two positions or intermediate ones are possible in Abolites designed for reflectors with 2¼-in. fitters—that is, for lamps 25 to 100 watt inclusive.

The same principle applies to reflectors with 3¼-in. fitters, *i.e.,* 150 to 500 watt inclusive. Two pendant (2¼ and 3¼ in.) and two ceiling (2¼ and 3¼ in.) Abolites take care of practically all single light illumination requirements on all lamps 25 to 500 watt inclusive. This obviates the necessity of carrying a large and diversified stock of lighting fixtures and accessories.

A complete Industrial Abolite is made up of two parts, the universal holder socket and the scientifically designed steel reflector. The following table outlines the salient features of the Industrial Abolite:

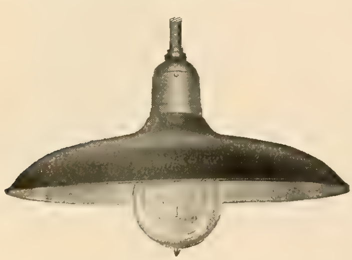


FIG. 7.—250-WATT 18-IN. DOME ABOLITE.

1. Positioning device provides for O, H and A positions.
2. Eliminates all separable holders.
3. One holder socket universal for all lamps, 25 to 500 watt inclusive.
4. All weight suspended from holder socket itself.
5. Reflector removed for cleaning without breaking any wire connections or disturbing the holder socket already in place.
6. Intensive and extensive illumination obtained with the same Abolite by simply changing positioning device.
7. Larger or smaller units can be substituted for those in place without touching the holder socket already in place.

In connection with this line, the Adams-Bagnall Electric Company has established a department of Efficiency Engineering for the purpose of studying industrial conditions and co-operating with industrial managers in bringing their illuminaton to a plane where labor efficency and factory output will be greatly increased.

The work of this department is part of the general efficiency movement just launched, and we feel that the initiative taken by this company in the etsablishment of such a department will do much toward improving general industrial lighting conditions.

New Publications

"MAZDA" INCANDESCENT STREET LIGHTING.

This is Bulletin No. 16 issued June 1, by the Engineering Department of the National Electric Lamp Association, Cleveland, O. The subjects treated are: Fundamental Requisites of Good Street Lighting; Arrangement of Units; Lighting in Business Sections; Lighting in Residence Sections; Lighting in Suburban Streets; Lighting of Parks and Boulevards; Installation and Construction. The bulletin contains 20 pages, is fully

illustrated with half-tones and diagrams, and contains both photometric data and figures showing cost of installation and maintenance of Mazda lighting systems.

Economical Operation of Incandescent Lamps.

This is Bulletin No. 17 issued May 15, by the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, containing 15 pages. It explains the meaning and use of the three voltage ratings of incandescent lamps, and gives tables and curves showing how they can be most economically used under different conditions.

Removal Notice

The Holophane Glass Company (the manufacturing company) formerly having its executive office at 30 Church Street, and the Holophane Company (the selling company) having its New York sales office at 36 West 39th Street, have both removed to the new building at 16 East 40th Street, of which they occupy an entire floor. The office of the New England Department, formerly located at 93 Broad Street, Boston, has been removed to 10 High Street.

The H. W. Johns-Manville Company Have a New Home

The H. W. Johns-Manville Company, New York, well known to the electrical fraternity and illuminating engineers by reason of their many varieties of electrical fittings and material, and as producers of the Linolite lamp, will soon join in the uptown movement. A very handsome building for their exclusive use is being erected at Madison Avenue and 41st Street. This will be the first manufacturing concern to occupy a twelve story office building in the "Murray Hill section" exclusively for office purposes. No comments are needed as to the evidence which this bears of the increasing business of this progressive house.

Personal

Mr. Evan J. Edwards has recently been appointed associate engineer in the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio. Mr. Edwards was instructor in electrical engineering at the Massachusetts Institute of Technology for three years after his graduation from the University of Iowa in 1907. For the past year he has been in charge of the course of instruction in illuminating engineering, which is given to new technical graduates coming with the National Electric Lamp Association.

N. E. L. A. Now Has Over 9,000 Members

"The brilliant and successful administration of Mr. W. W. Freeman as president of the National Electric Light Association came to a close June 30, with a total of no less than 9214 members. He began his term with a total of 5736, which would give a gain of 3478 for the twelve months. This is, of course, unprecedented in the annals of engineering bodies, but it is believed that the coming year under President Gilchrist may see the figures matched, as there is a strong movement on foot in all parts of the country toward the formation of company sections and the affiliation of State associations. There are indications that the membership during the coming year will easily reach not less than 12,000."

The above facts have been furnished us by the executive secretary, Mr. T. C. Martin, who, with his characteristic modesty, keeps himself entirely in the background in relation to the phenomenal growth of this important body. It is no disparagement of the energy and efficiency of President Freeman's régime to emphasize the importance of Mr. Martin's invaluable services in this work. Andrew Carnegie once testified in a Government investigation that "when he had Schwab with him he made a great team"; Mr. Martin makes a great team with any progressive, straightforward man like Mr. Freeman or Mr. Gilchrist, and his prediction as to the future growth of the N. E. L. A. is undoubtedly on the safe side.

Proceedings of Technical Societies

Canadian Electrical Association

The twenty-first annual convention of the Canadian Electrical Association was held at Niagara Falls, June 21 to 23. Among the papers presented was one on "Ornamental Street Lighting," by T. F. Kelly of the Hamilton (Ont.) Electric Light & Power Company. The paper dealt with ornamental street lighting installations in Westminster, Vancouver, Victoria, St. Catherines, Fort William, Ottawa and Hamilton. The system used in the last mentioned city was particularly dwelt upon. All of the installations are of the cluster type, generally using five lamps, but in some cases four or three. The Hamilton installation was described by Mr. Kelly in one of our previous issues. A general discussion followed the presentation of the paper, the question of maintenance of cost being particularly brought up. The interesting fact was brought out that experience had shown that good street illumination increases the use of window and sign lighting.

Michigan Electrical Association

The annual convention of this association was held on board the lake steamer *Minnesota,* June 19 to 22. Two papers on illuminating engineering subjects were presented: "Improved Street Lighting," by R. M. Hemphill, Jr., of Ann Arbor, and "The Tungsten Incandescent Lamp and Its Development," by A. M. Klingman of Cleveland, Ohio. Mr. Hemphill treated of the series tungsten and magnetite arc lamps, drawing upon his own experience for the facts given. He also illustrated and described a concrete lamp-post which has been recently installed in Ann Arbor. He found the 65 c.-p. tungsten lamps to give 5000 to 6000 hours life. His experience with the magnetite arc system developed some drawbacks that partially offset the advantages of this type of lamp. The rectifier tubes required a fairly constant temperature (between 80 and 90 degrees F.); otherwise there was considerable breakage, and at best they required more attention than constant current transformers. He also referred to the high equipment cost of this system. In the discussion Mr. Misterski of Detroit, where a large installation of these lamps is in operation, reported a different experience, the rectifier tubes showing an average life of 2500 hours and some reaching as high as 6000 hours. He stated that the system had saved the city of Detroit $14,000 in the past year. He also spoke highly of the advantageous distribution of the light of this arc for street lighting purposes.

Mr. Klingman's paper traced the history of the incandescent lamp in a general way up to the drawn wire tungsten filament that has recently been announced. The properties of drawn wire filaments and of the lamps using it were particularly dwelt upon. Although the tensile strength of wire is reduced after a certain amount of use in the lamp, the writer claimed that it is still much stronger than the pressed filaments heretofore used.

American Institute of Electrical Engineers

Pittsburg Section

At the meeting on May 9 a paper was presented by Mr. W. Edgar Reed, in which the cost of operating arc lamps was discussed with special reference to its relation to municipal contracts for street

lighting, and also of the neglect of municipal lighting plants to account for all the items of expense connected with the operation of their arc lamps. The latter point was illustrated by taking the case of a nearby town in which the municipal plant claimed a $40 a year cost for operating its arc lamps, whereas, according to Mr. Reed's figures, it should have been $65.

San Francisco Section

At the meeting of June 23 a paper on "Methods of Calculating Illumination" was presented by Mr. L. S. Twoney. The paper reviews very completely all of the various methods of determining mean spherical candle-power and intensity of illumination on different planes from polar distribution curves.

Iowa District Gas Association

The seventh annual convention of this association was held at Clinton, Iowa, on May 24, 25 and 26. Among the papers presented was one on "Inverted Gas Arcs," by Mr. Walter M. Blinks of Kalamazoo, Mich. The writer starts out with some statistics which may perhaps be best classed under the old time phrase, "important if true." The writer places the number of gas arc lamps at present in use in the United States at 2,000,000, and states that "Figuring the consumption at the low average of 20,000 cu. ft. per lamp we get the enormous output of 40,000,000,000 cu. ft., or $40,000,000 worth of gas sales per year resulting from an investment of about half that sum in the fixture itself, all expenses of installation included. If this can be even approximately approached by the sales obtainable by similar expenditures along any line of gas or electricity promotion work I am not aware of it." Probably no one else is aware of it. The statement, however, is evidently only a case of too many ciphers; but the question is, How many extra ciphers have been added to the figures?

The writer then goes on to relate his personal reminiscences of the introduction of the electric light and the development of the gas arc, with more or less facetious references to the single unit gas burner and to competing manufacturers of gas arcs.

The writer's views in relation to photometry and advertising are ingenious and interesting:

> Candle-power figures are largely a matter of advertising ability in giving results without particularizing on method. The system began back in the days when an open circuit electric arc was called 2000 c.-p. The automobile headlight, with its powerful concentrated beam of light, shows how a source of small power may be magnified; it would be manifestly unfair to make a photometer reading of this beam and report it as the value of the acetylene flame. On account of this I shall not cumber this paper with a lot of photometer readings, but simply say that the inverted arc of the best class on normal pressure will run from 25 to 30 candles to the cubic foot throughout the 75 zone below horizontal, while the upright mantle arc with shade gives but about 20 candles. Possibly some misunderstanding may have arisen on account of reports giving results beneath a shade, really concentration. In many phases of outdoor lighting the only effective light needed is that in the lower horizontal plane, hence figures showing values of 50 candles to the cubic foot are entirely legitimate to offer your customer as the service available.

The statement that "In many phases of the lighting industry the only effective light needed is that in the lower horizontal plane" needs some elucidation. As there are an infinite number of possible lower horizontal planes, it is not clear which one is referred to; and it is difficult to understand how the light could be so manipulated as to double its intensity throughout the angle necessary in outdoor lighting, which extends through nearly the whole lower hemisphere. As the writer lays down the proposition to begin with that "Candle-power figures are largely a matter of advertising ability in giving results without particularizing on method," we may readily ascribe his failure to particularize in this case to his own advertising ability, which is of no mean order, as shown throughout the paper. On this proposition he says further:

> I do not want to be understood as belittling scientific tests of illuminating agents, but it is against the cleverly phrased and illustrated combination of science and commercialism that you must guard. There is, I believe, very little if any actual misrepresentation of results in photometer work; about all the figures you see are true under the test conditions. Busy gas men, especially in the smaller works, have not the time to study out all the relations between those test conditions and that of the actual situation they must meet.

Passing by the more complex problems involved in reducing to practical form and workaday conditions, here is a simple instance showing how easily one may lose out if guided solely by theoretical knowledge gained from printed reports. The Humphrey four-mantle upright arc lamp, as tested by the Electrical Testing Laboratories of New York, compared with figures from the same source for the Humphrey three-mantle inverted arc, are as follows:

Kind of gas arc lamps, Humphrey.	Consumption per hour, cu. ft.	Candle power and angles. 0°	15°	30°	45°	60°	75°	90°
4 mantle upright	19	266	312	310	365	376	396	376
3 mantle inverted	11	238	265	271	288	306	291	266

Readings under more favorable conditions have shown considerably higher candle-power for each lamp, but I use these because they were taken under identical conditions. Here we see that in no direction is the three-mantle inverted arc shown to give as strong an illumination as the four-mantle upright, and on the figures one might hesitate to attempt the substitution of one for the other. Still, in the city of Kalamazoo we have changed scores of installations, lamp for lamp, with the invariable verdict from the user that his store is better lighted than before.

I am not here to condemn photometer readings, but I do unhesitatingly say that they are not to be accepted as the court of last resort as to what constitutes a practical, merchantable system with which you are to satisfy your trade.

Those stores with the three-mantle inverted lamps are not as light at the ceiling and upper shelves; this is noticeable to me, but has never been commented on by the merchants. Probably if we rely on the photometer there isn't as much light anywhere, but if the consumer is pleased and his gas bill reduced in the proportion of 11 to 19, what more can be asked as a selling argument for gas? Why, if our electric friends had a snap of this kind it wouldn't bother them a moment; they would promptly invent a scientific hypothesis that would be published in every newspaper in the land, showing that certain rays, unmeasurable on the photometer, but plainly evident to the human eye, were produced in this startling lamp, and probably add that these rays, properly directed, would cure baldness, indigestion, corns and ingrowing nails.

Not being as busy as the gas man in the smaller works, we will take time to do a little figuring on the results of laboratory tests given. All light in the lower hemisphere (" lower horizontal plane "?) is effective in producing illumination, particularly in stores where it is necessary to illuminate the side walls where goods and shelving are usually located. It is hence fair to compare the mean lower hemispherical candle-power of different light-sources. The four-mantle upright arc gives 366 l. m. s. c.-p. and the three-mantle inverted arc 288; the five-mantle arc giving 19 hemispherical candles to the cubic foot of gas consumed and the three-mantle 26. The three-mantle arc thus gives 21 per cent. less light and burns 42 per cent. less gas, which is certainly a sufficiently favorable showing for the inverted lamp, without the help of any particular advertising ability.

So much for scientific measurement unaided. With the help of " advertising ability without particularizing on scientific method," however, it appears to be possible to persuade the user that he is getting more light from a lamp actually giving 20 per cent. less illumination; " but if the consumer is pleased and his gas bill reduced 40 per cent., what better selling argument for gas? " With our limited advertising ability we do not see clearly how reducing a customer's light 20 per cent., and his gas consumption 40 per cent. is a particularly good argument for either the gas company or the consumer.

But having disentangled himself from the intricacies of photometry, the writer a few paragraphs farther on takes a saner view of the subject:

" Therefore, I repeat, be very sure you have the situation sized up. If it is a big store and you think it should have more light, fearlessly advocate a five-mantle inverted arc, without regard to anything that may have been said about reducing the cost. Give the results and payment will come easily. Costs never hurt any business as much as poor service; use the lamp that you in your better judgment decide best answers the purpose."

The writer then discusses the question of rental versus selling of gas arc lamps by gas companies, favoring the former practice.

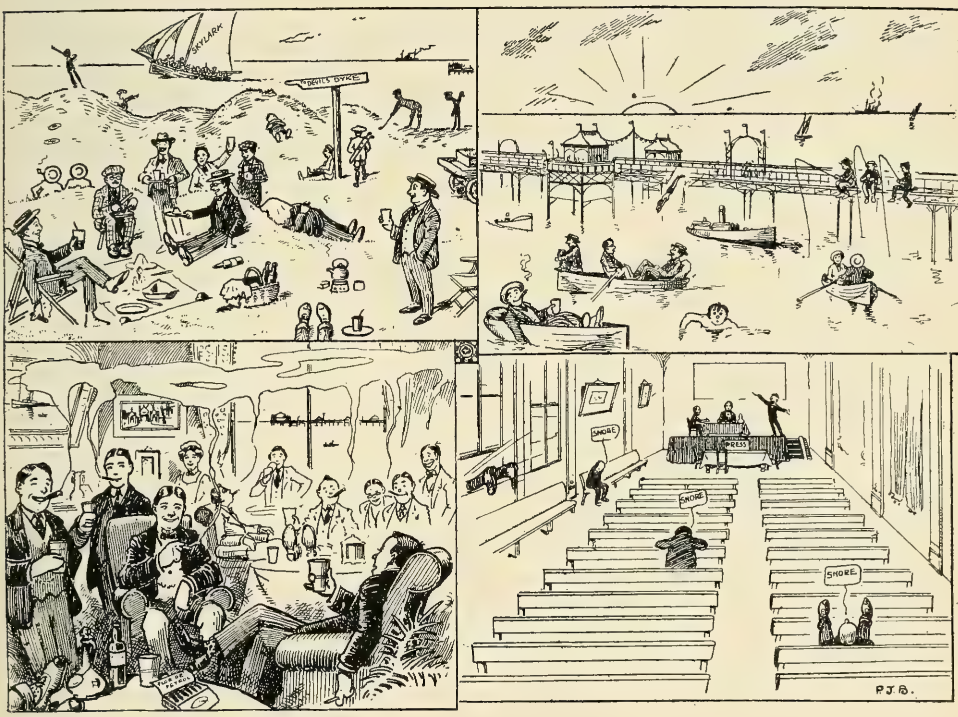
The fling that the writer takes at his

electrical competitors shows that he has felt the edge of their steel in his own experience, which may account in no small degree for his poor opinion of the "combination of science with commercialism." The fact is that the electrical people have been aggressive and progressive in applying illuminating engineering to the furtherance of their business interests, with very marked success. The Mazda or tungsten electric lamp carefully engineered can beat the gas lamp put in at random. "Advertising ability" alone will not sustain even the modern gas lamp against the "combination of science and commercialism," which constitutes a legitimate phase of illuminating engineering. If the gas interests want to persist in ignoring science they must expect to see their electrical competitors who make every possible use of it gradually supplant them in the lighting business. The boy that gets "licked" in a hand-to-hand encounter very often soothes his wounded feelings by getting on the fence and calling his antagonist names. An explosion of epithets is consequently an indication that some one has received a drubbing.

Ohio Retail Jewelers' Association

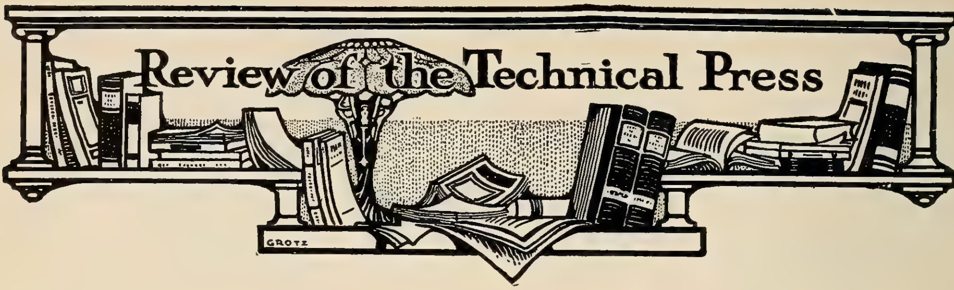
At the annual convention of this association held on June 26-28, Mr. J. G. Henninger of Cleveland, Ohio, delivered an address on "Jewelry Store and Window Illumination."

Mr. Henninger's paper dealt with the various factors to be considered in the choice and location of lamps and of reflectors for satisfactory and efficient results. The talk was illustrated by stereopticon, and was supplemented by a demonstration of several types of reflectors, showing their respective fields of usefulness.



From Electrical Industries, London.

AN ELECTRICAL CONVENTION AS SEEN BY AN ENGLISH CONTEMPORARY.
DID YOU EVER SEE THE LIKE IN *this* COUNTRY?



American Items

New Books

DAS LICHT. AUSFUEHLICKE UND ALLGEMEIN VERSTAENDLICHE DARSTELLUNG VON HUGO WERTH. Mitglied der Astronomischen Vereinigung von Moskow. Mit 482 Abbildungen und Einer Spectraltafel in Farben. Wien und Leipzig. A. Hartleben's Verlag, 1910.

Illuminating engineering is an applied science, an art based on the science of light. An illuminating engineer worthy of his profession has to know the physics and chemistry of light in order to apply this knowledge to the tasks confronting him in his occupation. Unfortunately there are only few books dealing with the subject of light in a popular and comprehensive, scientific and up-to-date way and manner. Such a book we have before us in the work of Hugo Werth.

The book is an excellent guide for self-study. It is not burdened with higher mathematics. Only the knowledge of the elements of algebra and geometry are necessary for the perusal of the book. Where trigonometric functions are applied, they are explained each time to the reader.

The part devoted to optics is especially well written.

The exposition of the electro-magnetic theory of light is elucidated by a brief summary of the basic principles of electricity. A clear picture of the unity of natural forces is hereby presented to the student.

A systematic index in alphabetical order makes the work serviceable for references.

The illustrations are good.

The only weak part of the book is the chapter on photometric work. The latest and best practical instruments are not described. The contents of the book are treated in fifteen chapters. The first part comprises the following chapters:

1, Experimental Optics; 2, Photometry; 3, Reflection; 4, Refraction; 5, Dispersion; 6, Universal Radiations; 7, Physiology of Vision; 8, Optical Instruments; 9, Velocity of Light.

The second part is divided in the following chapters:

10, Theoretical Optics; 11, Interference of Light Waves; 12, Diffraction; 13, Light as a Wave Motion; 14, Polarization; 15, The Electro-Magnetic Theory of Light.

The reviewed work is to be recommended as a valuable addition to the library of all interested in illumination.

ISIDOR LADOFF.

TEST OF A RESTAURANT LIGHTING INSTALLATION; *Electrical World,* July 1.

An illustrated article giving the results of tests of one of the "all-night" Childs restaurants in New York City. The installation consisted of Mazda lamps in Holophane ball reflectors. The summary of the tests is as follows:

Station.	Foot-candles.	Station.	Foot-candles.	Station.	Foot-candles.
1*	12.7	9*	8.8	17	6.3
2	7.8	10	5.0	18	8.9
3	6.0	11	5.6	19	5.9
4	5.1	12	4.2	20	7.2
5*	10.5	13*	11.8	21	5.4
6	5.5	14	4.8	22	7.1
7	5.6	15	4.0	23	6.0
8	4.2	16	5.7	24	9.2

* Stations that were directly under lamps.

"The test indicates that the average il-

lumination of the space investigated is 6.8 foot-candles, varying from a minimum of 4.0 to a maximum of 12.7. The average intensity at the four stations directly under the lamps is 10.9 foot-candles. The area lighted by one unit is 162 sq. ft.; the lumens per lamp effective in producing this illumination are, therefore, the product of 6.8 and 162, or 1102 lumens. The total light flux given by a 250-watt lamp of the make in question operated at its rated initial specific consumption of 1.13 watts per candle is 2168 lumens. Hence the 'illumination constant' or efficiency of the system under test conditions is the quotient of 1102 and 2168, or 51 per cent. The lumens effective per watt are 4.4, a high value for diffusing globes even when used with high efficiency lamps in light colored rooms. The fact that the globes absorb very little light and the fact that they embody a reflecting device both contribute toward the efficiency of the illumination."

CONCRETE LAMP-POSTS AT ANN ARBOR, MICH.; *Electrical World*, July 8.

An illustrated article describing the construction and use of a post made in that city.

INCANDESCENT STREET LIGHTING IN WARREN, OHIO, by A. E. Lennox; *Electrical World*, July 8.

An illustrated article giving a detailed description of the new lighting installation in that city, which consists of Mazda lamps supported on gooseneck brackets attached to wooden poles and equipped with Wheeler reflectors in the residential section, and cast iron posts with two pendant and one upright Mazda lamp equipped with Alba globes in the business section.

ILLUMINATION OF THE BRONX OFFICE OF THE NEW YORK EDISON COMPANY; *Electrical World*, July 22.

A brief illustrated article. The front of the building is illuminated with rows of lamps along the cornice at the roof and above the show window.

SPECIAL LIGHTING AS AN ARCHITECTURAL FEATURE OF A BUSINESS BUILDING; *Electrical World*, July 22.

An illustrated article describing the exterior lighting of the La Verne Building, Michigan Boulevard, Chicago. The building is noteworthy as having been designed with special reference to illumination as a feature, both on the exterior and interior.

ORNAMENTAL STREET LIGHTING IN KOKOMO, IND., by O. M. Booher; *Electrical World*, July 22.

An illustrated article describing a recent installation of tungsten cluster lamp-posts in that city. The cost of installation was borne by private subscription, the cost of maintenance for five years being paid by the city. The merchants paid at the rate of $1.15 per front foot; the local central station receives $4.05 per post per month for maintenance. The four-pendant lamps are 60 watt and the upright lamp 100 watts.

TUNGSTEN STREET LIGHTING IN SHREVEPORT, LA.; *Electrical Review and Western Electrician*, June 24.

An illustrated article describing a recent tungsten cluster installation in this city.

LIGHTING A FACTORY, by E. R. Treverton; *Electrical Review and Western Electrician*, July 8.

An illustrated article describing the illumination of a modern shop which received very little daylight. Westinghouse tungsten lamps and prismatic reflectors were used, placed on the ceiling, which was comparatively low, and underneath which a traveling crane operated. The specific consumption is 1.25 watts per square foot of floor space. The resulting illumination is adequate and satisfactory, the average intensity on the working plane being 2.5 foot-candles, with a minimum of 1.6 at the extreme end of the room. The installation has been in use for over a year, and notwithstanding the unusual amount of vibration and jar, the lamps have shown no unusual breakage.

STREET ILLUMINATION, by W. T. Ryan; *Electrical Review and Western Electrician*, July 15.

The article gives the curves of luminous intensity on the horizontal and vertical planes as determined by two senior students of the Electrical Engineering Department of the University of Minnesota at different places in Minneapolis.

ELECTRIC ILLUMINATION AT KING GEORGE'S CORONATION, by a spe-

cial correspondent; *Electrical Review and Western Electrician,* July 22.

An illustrated article describing at some length the features of the electric illumination during the Coronation ceremonies.

THE NEW CHICAGO PASSENGER TERMINAL OF THE CHICAGO & NORTHWESTERN RAILWAY, WITH SPECIAL REFERENCE TO THE ILLUMINATING THEREOF, by C. A. Luther; *American Gas Light Journal,* July 24.

An illustrated article describing the lighting and power installation of this building.

HOLDING LIGHTING BUSINESS, by R. M. Thompson; *Progressive Age,* July 15.

This is article No. 5 in the competition series on single mantle lighting, and illustrates and describes the lighting of a department store in Boston with reflex inverted burners.

REFLEX LIGHTING IN READING MILLS, by Forest G. Sindel; *Progressive Age,* July 15.

This is article No. 6 of the series above referred to, and illustrates and describes the lighting of a combined textile and garment factory with reflex gas lamps.

While these articles do not give any illumination data, they are instructive as demonstrating that the modern gas lamp is capable of maintaining gas illumination for both industrial and commercial purposes. In both installations the owners express themselves as being highly satisfied with the results, and in the textile mills the operatives similarly express themselves.

VANCOUVER'S LIGHT CAMPAIGN, by W. B. Foshay; *Progressive Age,* July 15.

A short article very fully illustrated setting forth the progress made by the gas company in this city in pushing gas illumination. The article demonstrates what can be done by aggressive campaigning.

THE ILLUMINATION OF STREETS AND OPEN PLACES, by E. Darrow; from the Michigan *Technic,* reprinted in *Municipal Engineering,* July.

The writer, who is a consulting engineer, goes over the whole subject with special reference to the cost of maintenance of the different light-sources available for exterior illumination. It contains much useful information on the subject in a condensed form, from which the following excerpts have been made:

With the increasing use of powerful arcs there has become a needless distress to the man in the street. When used for street illumination such arcs should be swung high. The time has passed when high candle-powered arcs should be thrust in the faces of pedestrians.

Such glare as in evidence on Broadway, St. Louis or Summit street, Toledo, is a garish display, and is most unpleasant to the public, and should be regulated. The glaring arc can be, and ought to be, abolished.

Dr. Steinmetz has pointed out in an admirable manner that eye fatigue is a question of the energy imparted to it by the radiations received. Further, the blue end of the spectrum possesses much less energy than the red. Also with the greater divergence of color in more recent light-sources, and the greater knowledge of the physiological effects of radiation in general, the importance of considering the color of light-sources on purely physiological grounds has become a serious matter.

Frosted globes and diffusing reflectors tend to prevent troublesome reflection and mitigate glare. * * *

Maintenance costs in the curb line system of illumination, such as adopted in Des Moines, Seattle and Indianapolis, are about as follows per 1000 hours of burning, each post five 100-watt tungstens:

(a)	Five lamps	$5.00
	Glassware	2.00
	Cleaning and attendance	1.00
	Depreciation	2.00
	500 kw. h	5.00
		$15.00
(b)	Maintenance D. C. inclosed arcs:	
	Carbons and trimming	$1.20
	Repairs and globes	0.50
	Depreciation	2.00
	500 kw. h	5.00
		$8.70
(c)	Maintenance metallic flame arcs:	
	Trimming	$7.50
	Repairs and glassware	2.00
	Depreciation	2.00
	500 kw. h	5.00
		$16.50
(d)	Maintenance flaming arcs:	
	Carbon and trimming	$9.50
	Repairs and globes	2.00
	Depreciation	2.00
	500 kw. h	5.00
		$18.50

The energy required for these various systems of lighting varies from 6 to 60 kw. per mile roadway.

An ordinary 60-ft. roadway has about 315,000 sq. ft. to the mile, and with the American average of 5 to 10 kw. per mile, this allows a ridiculously low wattage per square foot.

The consummation of energy per square foot per foot-candle is about as follows:

Tungsten lighting	0.3 to 0.5
Inclosed D. C.	0.25 to 0.45
Metallic flame	0.06 to 0.13

The radius of action for tungsten Luxolabra types is

about	100 ft.
Inclosed arc lamps	125 ft.
Metallic flame	300 ft.

From the above considerations it would appear that due to the combined influence of public sentiment, first costs and maintenance charges, series burning constant metallic flame lighting units are driving all other types of illuminants from the residence and suburban districts of our municipalities. However, there is a strong trend in business sections of our progressive cities to artistic lighting effects, as is evidenced by the many attractive forms of arches and curb line lighting which have been developed in the past eighteen months. . . .

The Illumination of the Cathedral of St. John the Divine, by James Robert Moore; *The American Architect,* July 12.

An illustrated article describing in detail the illumination of this building.

Foreign Items

Compiled by J. S. Dow

Illumination and Photometry

Light and Shade in Indirect Lighting, by J. Eck (*Electrician,* June 23).

An article bearing on the contribution on this subject by Haydn T. Harrison mentioned below. The author takes up the suggestion that a flat white disc and a white sphere would look the same by indirect lighting; he shows a photograph of two such objects hung up one below the other in a studio lighted by inverted arcs. The photograph makes it clear that there is a well marked shadow in the case of the sphere, and a statue under the lamp also shows good relief. The author also supplements these results by readings of the actual density of shadow by means of the Holophane Lumeter instrument; he shows that, although the average illumination by day and artificial light was not the same, the *ratio* of the dark and light portions was almost identical.

Die Schattenbildung und Ihre Berechnung, by K. Norden (*E. T. Z.,* June 22).

This author likewise takes up the question of shadows. He contends that more precise methods of comparing the conditions of light and shade obtained with different illuminants are needed and proceeds to define "diffusion," "shadow density," etc. He also attempts to secure formulæ enabling the depth of shadow cast by a series of sources to be calculated.

Effects of Radiation in Photography and Telegraphy, by T. Thorne Baker (*Engineering,* June 16).

The author refers to the effect of light of different colors on bacteria; some growths are retarded by light, others are accelerated; for example, the fermentation of sugar is assisted by exposure to red rays. An interesting analogy can also be drawn between the behavior of the eye to colored light and the behavior of photographic plates.

The Illumination of an Up-to-Date Bakery (*Illum. Eng.,* Lond., July).

An account of a bakery at Reading illuminated by inverted arc lamps. Some data regarding the uniformity of illumination secured are presented and also some photographs taken solely by artificial light.

The Nomenclature of Primary and Secondary Sources of Light, by Haydn T. Harrison (*Electrician,* May 26).

The author argues that a distinction should be drawn between illumination due to direct lighting and that due to extensive

illuminating surfaces, walls, ceilings, etc. He suggests, for example, that by an indirect system of lighting a white disc and sphere might look exactly the same owing to the absence of shadow. This article called forth an answer from J. Eck (see above).

ILLUMINATION IN FACTORIES AND INDUSTRIAL ACCIDENTS (*Illum. Eng.*, Lond., July).

A summary of the evidence in the recently issued "blue book" containing the report of the departmental committee on accidents in factories. Many practical instances are given of accidents which have occurred owing to premises being poorly lighted.

STANDARD SPECIFICATIONS ON STREET LIGHTING (*Illum. Eng.*, Lond., July).

A collection of opinions by various Continental and European anthorities on street lighting, elicited in response to a list of queries on the subject. As a joint committee is now considering the framing of a standard specification on street lighting in England, this collection of views is valuable. At the end of the article the answers are summarized in tabular form.

RAILWAY LIGHTING, by R. T. Smith, (*Railway Gazette*, June 9).

THE PERFECT MINER'S LAMP (*Elec. Times*, June 1).

DAS HOLOPHAN LUMETER (*Z. f. B.*, June 10).

ILLUMINATING ENGINEERING IN CINEMATOGRAPH WORK (*Illum. Eng.*, Lond., July).

Electric and Gas Lighting

NOTES ON ELECTRIC STREET LIGHTING, by L. Crouch (*Elec. Rev.*, June 2, 9, 23).

This article contains a considerable amount of data collected from various sources bearing on the efficiency, polar curves of light distribution, intrinsic brilliancy and cost of various street electrical illuminants.

LES LAMPES À FILAMENT METALLIQUE, BOURRELLY (*Soc. Belge Elect. Bull.*, May).

Refers to the weaknesses of existing tungsten lamps, notably the long length of wire to be supported, which makes the lamps fragile, and the fact that most light is sent out sideways instead of downwards. In a new type of lamp, the "Leila," horizontal filaments or a combination of horizontal and vertical filaments are used with improved results.

ARC LAMP PRACTICE (*Elec. Engineer*, May 19).

Gas, Oil, Acetylene Lighting, etc.

ADVANCES IN MANUFACTURE AND USE OF GAS, H. Bunte (*J. G. L.*, May 30).

DIE VERBESSERUNG DER STRASSENBELEUCHTUNG IN STUTTGART DURCH GASSTARKLICHT, F. Göhrum (*J. f. G.*, May 25).

Describes the developments in gas street lighting in Stuttgart, where high pressure air lamps are being suspended on wires spanning the streets. The question of side street lighting, either by metallic filament lamps or low pressure gas, is under consideration. In order to avoid the sudden alteration in brilliancy in passing from these streets to the main thoroughfares it is proposed to grade the lamps using 1500-c.p. lamps near the main road, 1000-c.p. lamps in the middle and 500 at the further end.

COMPARISONS OF UPRIGHT AND LOW PRESSURE BURNERS, M. Grebel (*J. G. L.*, May 30).

DISTANCE IGNITING SYSTEMS (*J. G. L.*, May 30).

SECURITAS GAS LIGHTER AND EXTINGUISHER (*J. G. L.*, June 6).

DIE PETROLEUMGEWINNUNG IN KALIFORNIEN (*Z. f. B.*, May 30).

AUTOMATIC DISTANCE LIGHTING OF GAS BURNERS (*J. G. L.*, June 6).

TESTS ON ACETYLENE BURNERS (*Acetylene*, May).

Contractions used:
E. T. Z. Elektrotechnische Zeitschrift.
G. W. Gas World.
Illum. Eng. Lond. Illuminating Engineer (London).
J. f. G. Journal für Gasbeleuchtung und Wasserversorgung.
J. G. L. Journal of Gaslighting.
Z. f. B. Zeitschrift für Beleuchtungswesen.

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LEADERS AND FOLLOWERS

Mankind, considered from the social, political and commercial standpoints, can be divided into two classes: leaders and followers. He who is not one of these is the other.

Leadership arises from clear vision, constructive imagination, and moral courage. This is a combination of qualities which is rarely possessed to a high degree; hence the rarity of great leaders and the overwhelming preponderance of followers. This condition must continue to exist until human nature reverses its habits; it can never be overthrown by any artificial measures devised by man.

Clear vision surveys the larger field of human activities, and sees events in their true perspective. The average observer judges of the importance of objects by their APPARENT size, that which is nearest appearing the largest. He of the clear vision, who judges carefully the size or importance of the distant object or event, was of old called a Seer; and to-day far-sightedness is recognized as an attribute as valuable as it is unusual.

Constructive imagination builds the future from the outward and visible signs of the present. It is a practical application of "the logic of events."

Moral courage impels its possessor to act from his own convictions, in confidence that the final results will justify his actions, and that obstacles met and overcome to-day will be rewarded by success to-morrow.

Man is constitutionally lazy. It is easier to follow than to lead; easier to run on a track than to blaze a new trail through the forest; easier to accept others' opinions than to think; easier to believe what others have seen than to investigate.

The leader is invariably the worker, and leadership often comes unsought as an inevitable result of the genius for work.

The merchant or manufacturer who is content to follow in the foot-steps of his predecessors must sooner or later find himself relegated to the rear of the procession. Old methods, old ideas, and old facilities will not do. The new to-day may be old to-morrow, and the best this year may be entirely outclassed a year hence. The whale-oil lamp was good in its day; so was the tallow dip and the flickering gas flame; but their day has passed. The dingy store and the half-lighted factory are rapidly passing. The commercial leader to-day is the one who utilizes the inventions and improvements of modern science to their utmost; and since this is a scientific and commercial age, the commercial leader will generally be found to lead socially and politically likewise.

As with individuals, so with communities. The city or town that gropes about in the obscurity of sparsely scattered and antiquated street lights must expect to see itself passed by in the march of prosperity. There is no half-way course; whether individually or collectively, man must lead or follow. The leaders are those who walk in the light, literally and metaphorically.

LET THERE BE MORE AND BETTER LIGHT!

E. L. Elliott.

An Innovation in Store Lighting

The commercial side of illumination is nowhere so strongly emphasized as in store lighting. The majority of stores, both great and small, in cities of any considerable size require the use of artificial light to a greater or less extent throughout the entire day. The quality of the illumination affects the quantity of sales, both directly and indirectly; directly by enabling the customer to make a satisfactory selection of goods, and indirectly by making the store attractive.

These are the two requisites, then, which determine the practical efficiency of any method of store illumination: to display the goods to their best advantage, and to give the store an appearance that will react favorably upon the customers' minds. While the cost of light is an item to be duly considered, and reduced to the lowest point consistent with the best results measured by sales, it would be a case of false economy to consider only the mechanical or theoretical efficiency expressed in watts per candle-power per square foot, or by any other similar formula. If doubling the cost of illumination can be shown to increase the sales so as to return this increased cost plus a profit, then of course it would be a good business investment to make the increase. Conversely, if the cost of illumination can be reduced without reducing the sales, then the saving is legitimate profit. If the illumination cost can be reduced, and the efficiency of the illumination measured by sales increased at the same time, the method used is worthy of special consideration.

FIG. I.—DECORATIVE MODEL, MAZDA STORE-LIGHTING UNIT.

There is no other case of artificial lighting in which the psychological factor plays so important a part as in store lighting. This applies to both sales people and customers. Purchases in stores are made, not by processes of logical reasoning nor as a result of scientific tests, but almost altogether from opinion or fancy. The customer buys what he *likes,* as a result of his general mental attitude quite as much as of his power of analysis and discrimination.

The two elements of a sale are the impression which the customer gets of the goods themselves, and the persuasion or argument used by the salesman. The effectiveness of the salesman is largely a matter of enthusiasm borne of his own belief in the goods. That this may have its full effect he must have what *he believes* to be the proper facilities for showing his merchandise. If he is handicapped either in fact or in his imagination by poor illumination he will lose the sharp edge of his enthusiasm and prove relatively inefficient as a salesman.

A modern department store is a complicated organism of buyers, department sales-managers, and clerks, and success depends upon this organization working both in harmony and with individual enthusiasm. On the question of illumination their verdict, after sufficient trial to overcome fixed ideas and prejudices, must be considered final. It is useless to advance scientific or other arguments in favor of a method of lighting which the

capable and experienced salesman has found unsuited to his purposes after a sufficient trial.

The inclosed arc lamp, which held the first place as a unit for store lighting for at least a decade, admittedly had its faults. The carbon incandescent lamp had still more serious faults of a different nature. The high candle-power, high-efficiency Mazda or tungsten lamp to a very large extent is free from the principal faults of both of these sources. It gives perfect steadiness, and a color sufficiently white for all practical purposes, together with an increase in economy both in respect to current consumption and maintenance.

The Mazda or tungsten lamp, however, is obviously entirely too brilliant to be used without some method of thoroughly diffusing its rays. Given a satisfactory method of accomplishing this essential, and the Mazda or tungsten lamp must inevitably take first place as a store illuminant. Scientifically speaking, illumination by metallic filaments of high intrinsic brilliancy must be accomplished by indirect methods—i. e., the visible source of light must be a surface of comparatively large area diffusing the rays by either transmission or reflection. Generally speaking, the comparative values of the two methods will depend upon the degree of diffusion, which will be directly proportional to the area of the visible luminous surface and the absorption of light by the secondary radiant. Translucent diffusing globes offer one practical solution of the problem, and diffused reflection from a white ceiling the other. The former method has been commonly practiced, with results that are generally familiar. It may be said of this method that it absorbs somewhat less of the light-flux, but gives less diffusion, the apparent source of light having a sharply defined area and greater intensity than in the case of reflection from the ceiling, or, as the method is now commonly known, indirect lighting.

The commercial advent of the metallic filament lamp, with its high-efficiency and high candle-power, has removed the only serious shortcoming of the indirect system of lighting—viz., its lower degree of physical efficiency. With an initial duty of

FIG. 2.—MAZDA LIGHTING UNIT, PLAIN MODEL.

1.4 watts per spherical candle, 8.8 per lumens watt—and an output of 440 horizontal candles—350 spherical candles, or 4390 lumens—and a guaranteed life of 1000 hours, the Mazda or tungsten lamp affords a means of producing illumination by the indirect method which effectually removes the handicap of physical inefficiency; while on the other hand, the perfect diffusion produced by this method, as recently proven by careful comparison with average daylight, offers a means of completely obviating the only objection to this new contestant for supremacy—viz., its high intrinsic brilliancy.

The efficiency or inefficiency of indirect lighting, however, has generally been based upon purely theoretical, physical measurements, and have left out entirely the even more important element of physiological effect. The measured intensity of illumination on an imaginary plane does not necessarily express the corresponding visual impression which the normal eye would obtain. Intrinsic brilliancy of the source, contrast between lights and shadows, the number and position of luminous sources, and other conditions would be important factors in determining the final result. As the ultimate object of illumination is to enable

FIG. 3.—A SECTION OF THE SILK DEPARTMENT.

the eye to see that method is most efficient which produces the best visual effect at a given cost, and this result, unfortunately perhaps, is incapable of physical measurement. One of the most conspicuous properties of indirect illumination is the ease and clearness with which the eye sees objects under a comparatively low intensity, and it is this same property which, by enabling the eye to see with less effort, or, as the physicist would say, with less work, that is invariably most prized by the user as soon as he has become accustomed to the absence of brilliant visible light-sources.

Indirect illumination has gradually made a place for itself in counting rooms, libraries, art galleries, and the best class of hotels; but the installation in the Greenhut-Siegel Cooper Company's Department Store in New York City is the first instance of its extensive use for store lighting. The history of this installation, together with a general description of the apparatus used, will therefore be of more than passing interest.

The first proposal to the proprietors to install this system met with the usual doubts as to its success. Like all progressive business men, however, they were quite willing to be shown. A section of one floor was therefore equipped as a demonstration. After the change of having illumination without any visible lights had ceased to attract the notice of the sales people, and they had begun to observe the restful effect upon the eyes, they gave their unanimous opinion in favor of the method; while the management, observing the daylight appearance which it gave to the goods, and the readiness with which customers could make satisfactory selections, determined then to extend the system throughout the building. As a matter of fact, a premium was actually paid in order that two entire floors might be equipped in time for the spring trade.

The fixtures used for the first reflection are of two styles, differing slightly in contour and decorative features. The fixture shown in Fig. 1 is used throughout the basement, and is supplied with one

250-watt Mazda clear bulb lamp. The fixture shown in Fig. 2 is used for the balance of the installation, and is supplied with a 500-watt lamp on the second floor and a 400-watt lamp on the other floors. The units are placed one in each bay on the outlets formerly supplying the inclosed arc lamps. These bays are 20 x 21 ft., having therefore an area of 420 sq. ft. The specific efficiency of the system is therefore .6 watt per square foot in the basement, 1.2 watts per square foot on the second floor and 1 watt per square foot on the remaining floors. The inclosed arc lamps formerly used were fitted with clear inner and opalescent outer globes, and consumed from 600 to 700 watts, averaging much nearer the maximum than the minimum figure.

The maintenance cost of the present system will be substantially the same as with the arcs. One trimmer has been employed to take care of the arcs, and his time is now given to cleaning and caring for the indirect units, and is found sufficient to keep them in good service condition. The cost of carbons may be considered a practical stand-off against the cost of lamp renewals. The present system therefore shows a saving of from 20 to 30 per cent. in current consumption with the same maintenance cost.

The illumination naturally created some adverse criticism on the part of the sales force when first installed, but this was an inevitable result of the radical difference in method. We are all so accustomed to seeing more or less brilliant light-sources scattered about us wherever there is artificial illumination, that it is second nature to conclude that where there is no visible light-source the illumination must be lacking. As soon as we forget that it is not the source of light, but its rays falling upon other objects, which enables us to see, we accept the conditions quite as naturally as we do daylight without looking to see if the sun

FIG. 4.—THE WHITE GOODS TABLES.

FIG. 5.—AN AISLE IN THE MILLINERY DEPARTMENT.

is shining. As soon as the novelty of the system ceased to attract attention from those using it, its greater comfort to the eyes made itself apparent. The final verdict is unanimous in its favor. While the photometric intensity on the "working plane"—i. e., about the counter level, is in some cases less than with the arcs, the visual effect is undoubtedly better.

The general quality of the illumination is indicated in the illustrations. While the photograph does not itself give any indication of the intensity of illumination, it does show with absolute fidelity its degree of uniformity, character of the shadows, and to a considerable extent the amount of glare.

Fig. 3 is a section of the silk department, which shows the general daylight quality of the illumination.

Fig. 4 is a section in the white goods department. There is no subject more difficult for the photographer to render satisfactorily than white draperies. The manner in which the details show in this photograph indicates that the illumination does not produce the flatness which has been sometimes erroneously charged to this method of lighting.

Fig. 5 is a view in the millinery department, and is given here to show the character of the shadows, and is convincing evidence that this method of lighting is not "shadowless" in the strict sense of the term. It is true that it does not produce the sharply defined shadows which are one of the objections to direct illumination, but it does produce the soft shadows, or variations of light and shade, characteristic of daylight.

Probably the most conspicuous case of the peculiar advantages of the use of this method is in the lighting of the art department, a view of which is shown on the front cover of this issue. If any method of utilizing artificial light may be said to produce artificial daylight it is this. The lighting of the art department, with

the exception of a slight difference in color almost unnoticeable, is the full equivalent of skylight illumination.

The practical conclusions to be drawn from this installation would seem to be as follows:

The high candle-power Mazda or tungsten lamp can be economically used for store lighting by observing proper methods of diffusing and distributing its light.

Indirect illumination by lamps of this type affords a thoroughly practical, and, measured by visual effects, efficient method of lighting.

Direct lighting by inclosed arc lamps, with the usual equipment of diffusing globes, can be replaced with high candle-power metallic filament lamps in indirect lighting units with a material saving in current consumption.

Improving Lighting Conditions in the Cloak, Suit and Skirt Industry in New York City

Probably no industrial institution has been more exploited by the sensational writer than the New York "sweat-shop." The song of the shirt has been resung in every possible key and with all manner of variations. No doubt the truth was bad enough without embellishment or exaggeration. Clothing of various kinds has been made in quarters that were so unsanitary as to be a menace to the health of those who purchased the product as well as to the workers who made it. Private greed at the best is a tough subject to cope with; and when it deals with ignorance and poverty, the problem of abating the evils is indeed a Herculean task.

Natural forces will, however, assert themselves in the end and a fair balance of nature be restored. Like other abuses of labor, the sweat-shop forced the laborers to unite, and the result of such union was the proverbial strength. In 1910 there was a general strike in the cloak, suit and skirt industry of this city. Among

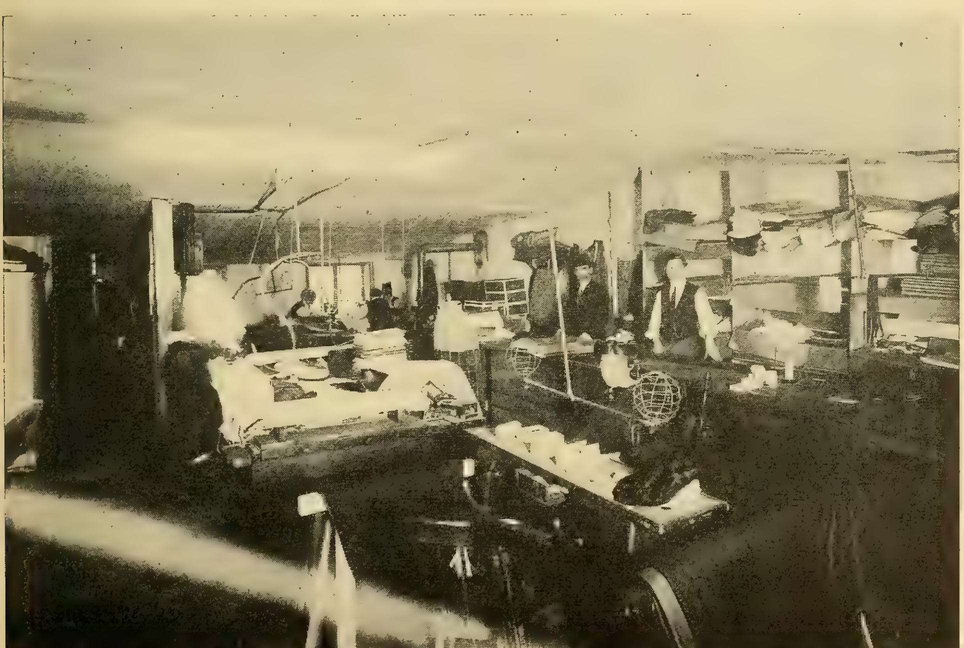


FIG. 1.—AN "EAST SIDE" SKIRT FACTORY LIGHTED BY GAS FLAMES.

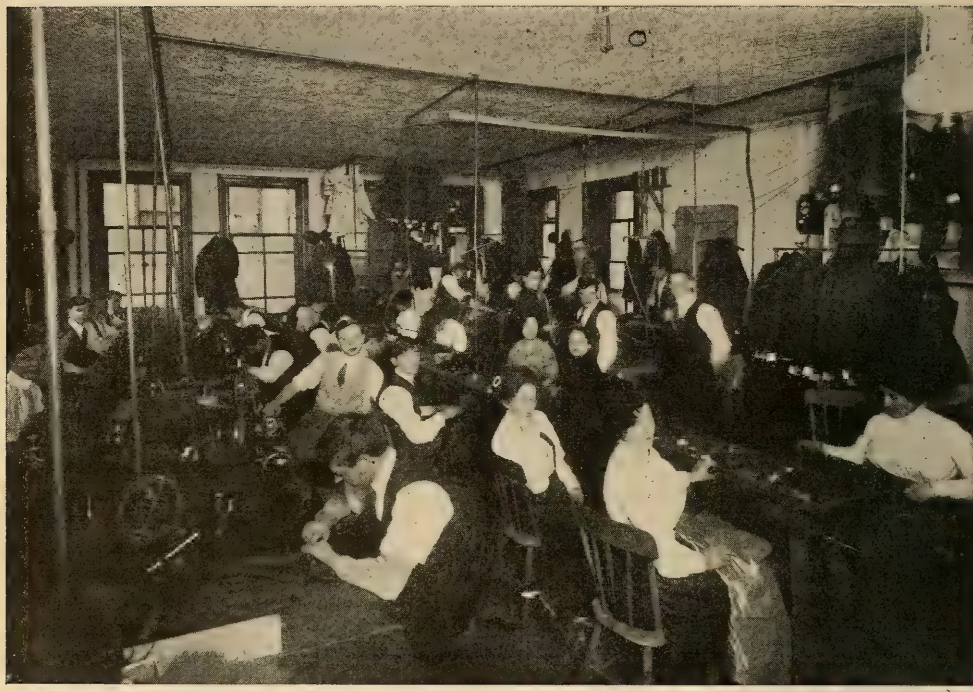


FIG. 2.—AN "EAST SIDE" GARMENT FACTORY, SHOWING A TYPICAL ARRANGEMENT OF GAS BURNERS.

the chief complaints of the workers was the unsanitary condition of the rooms in which they were frequently required to work. It was a foregone conclusion that a strike based on such obviously just demands as decent working quarters must end in victory for the strikers. One of the results of this strike was the mutual agreement of the employers and the union to refer all matters pertaining to the conveniences and sanitation of workshops to an impartial Board of Arbitration, which was called the Joint Board of Sanitary Control. Soon after its appointment this board secured the services of a corps of experts on the various phases of sanitation and safety, among which was included an illuminating engineer. Investigation was made of every room or workshop that could be found in which garments of the class mentioned were made by regular employees. Something over twelve hundred such places were inspected in the Borough of Manhattan.

A few typical shops showing various methods of artificial lighting are shown herewith. There is a rather sharp line of demarkation between the shops on the East and West sides. The former are often located in old or remodeled buildings, and exhibited the worst conditions as to light, ventilation, safety in case of fire and sanitary conveniences. The West Side shops are, as a rule, in comparatively new buildings erected for general manufacturing purposes and are fairly well supplied with daylight and other necessary utilities. One-third of the number of shops were found to be lighted with gas. In many of these the lighting conditions were found to be as bad as could possibly exist. A typical and common method of illumination is by means of two-arm chandeliers made of common gas pipe and fitted with ordinary flame tips, and usually supplied with a double L near the ceiling, permitting the fixture to be turned up out of the way when not in use. These fixtures were fitted with coarse wire guards to prevent pieces of cloth or paper from falling into the flame, and were usually swung down between two rows of sewing machines, so that the operators faced the lights while the shadow of the needle and presser foot

FIG. 3.—AN "EAST SIDE" CLOAK FACTORY WITH SINGLE MANTLE GAS LAMPS.

FIG. D.—A "WEST SIDE" CLOAK AND SUIT FACTORY, LIGHTED BY METALLIC FILAMENT LAMPS.

of the machine was thrown in front, where the illumination should have been the best. It would be impossible to conceive of any use of modern illuminants in a manner to produce a more faulty illumination. In a few cases gas arcs were found installed along with the gas flames.

Fig. 1 shows a typical room with the gas fixture described and Fig. 2 another room of the same type, showing the gas fixture between the two lines of machines. Sometimes the long chimney or self-intensifying single mantle burner was used instead of the arc, as is shown in Fig. 3.

Fig. 4 is a view in one of the factories which was marked perfect by the inspectors in all other respects. It is a large institution, and one in which the managers have made apparently every effort within their knowledge to provide for the comfort and health of their employees. The lighting, however, is decidedly bad. The small reflectors were evidently installed originally in connection with 16 c.-p. carbon lamps, but the carbon lamps have since been replaced by 40 or 60 watt Mazda or tungsten lamps, with a result that the intense glare of the metallic filament is left to do its worst upon the eyes of the operatives. Doubtless the management considered that they were conferring a real benefit on their employees by substituting the more powerful lamps. It was a case of good intentions miscarrying on account of lack of knowledge.

As a result of the investigations the Joint Board of Sanitary Control formulated a set of regulations to which every factory must conform in order to be considered fit for continuous occupation. Failure to comply with the rules may result in the calling out of all the employees by the union. There was one case of such action during the past winter, which, though unimportant in extent, may be epoch making in history.

The regulations concerning lighting are as follows:

Halls and stairways leading from shops to be adequately lighted by natural or artificial light.

Sufficient window space to be provided for each shop, so that all parts of the shop be well lighted during the hours from 9 a.m. to 4 p.m.

Where gas illumination is used, arc lights or incandescent mantles should be used.

All lights to be well shaded, to be placed above operatives, and not too near them.

Legal enactments regulating the sani-

FIG. 5.—AN "EAST SIDE" SHOP LIGHTED BY A SINGLE GAS ARC.

tary and other facilities of factories are good laws, and exist in most of the States. But a good law is one thing and its enforcement quite another; and those who have followed the subject find that the enforcement of factory inspection laws is far more difficult than getting them enacted. Organized labor can unquestionably be of greater assistance in this respect than all other agencies combined. Assuming that labor is sufficiently organized, it can have a standing committee in every workshop, which does not merely take an occasional look through, but makes a thorough inspection every day; and the calling out of the employees is a more effective method of enforcing compliance with regulations than any fines that the courts are likely to impose.

It is a matter of record that those strikes in which the labor unions have had just cause for complaint have ended in practical victory, while the strikes out of "sympathy," or to simply take advantage of a manufacturer's weakness, have been lost. Like all other movements organized labor is beginning to profit by experience. It has learned that public opinion is after all the greatest power in this country, and that it is useless to appeal to this tribunal without a sound moral issue: "he who seeks equity must come with clean hands."

There is no question that the public will back any reasonable demand on the part of organized labor for conditions conducing to the general health and comfort of workers. Among these conditions good and sufficient artificial lighting is of such evident importance that it would not be for a moment questioned by any thinking citizen. In turning over the question as to what constitutes reasonably good and sufficient illumination, as well as the other necessary facilities to disinterested experts, organized labor shows a spirit of fairness which must put the seal of approval upon all such efforts.

The days when the laborer had to put up with any sort of illumination that his employer might see fit to furnish are rapidly passing. Both the power of the State and of organized labor are arraying themselves on the side of good and proper illumination, along with other modern sanitary conditions. But like other laws, such regulations are for those who need protection. The majority will always be found above the law by anticipating its provisions, which, generally speaking, are for the benefit of the law abiding. The manufacturer who is compelled to put in good illumination, either at the instance of the State or the labor union, will receive more benefit that he will bestow.

A Street Lighting Excursion

By Roscoe Scott.

The apathetic disregard of its plight by the public in many ill-lighted localities bespeaks a pitiful ignorance of how the "other half" is living—for our more progressive cities and towns have secured, by means of good street lighting, benefits in trade, adornment, protection and prestige which could in no other way be gained at such reasonable cost. As individuals, we are often led to improve our conditions by drawing comparisons with our neighbors, and the same statement will apply to neighboring communities. All this, however, by way of introduction to a recent incident showing how public opinion on the street lighting question has been aroused in a certain Ohio town.

Salem, Ohio, a place of about 9,000 people, is located in Columbiana County, in the northeastern part of the State. About twenty-four miles north of Salem is Warren, the seat of Trumbull County, a bustling city of nearly 12,000 inhabitants. Two years ago the streets of both Salem and Warren were lighted in practically the same manner, open carbon arcs, few and rather far between, being set to "rule the night" during the stated absences of the moon. Only the more thickly populated sections of each town were thus favored.

The larger town, as it happened, was the first to improve its lighting conditions, and did so with a vengeance, taking out all of the ancient open arcs and replacing them by an installation which employs

metallic filament incandescents exclusively. To be specific, the new lighting equipment consists of 620 street series Mazda lamps supported on goose-neck brackets attached to wooden poles and equipped with Wheeler reflectors, in the residential section; 60 cast iron posts with one upright and two pendant Mazda lamps equipped with Alba globes in the business section; and 22 single-light standards with upright lamps around the central park. This system, which has been extended so as to illuminate the streets of Warren clear to the city limits, went into operation on June 7, 1911, and has already attracted a great deal of favorable comment, not only locally but nationally through the technical press.*—Salem still has her arcs.

Hearing that the street lighting franchise of the Salem Electric Light & Power Company was about to expire, a committee of public-spirited Warren citizens extended to their neighbor an invitation to "come over and see how we do it."—The invitation was accepted, and resulted in the "street lighting excursion" about to be described.

On Friday, July 21, a delegation of more than fifty prominent residents of Salem, headed by the Mayor and including members of the City Council and leaders in the city's business activities, all of them personally and vitally interested in municipal improvement, took a trolley trip to Warren for the purpose of inspecting its new lighting system and to consider informally the advisability of installing a similar one in their home town.

The party arrived in Warren early in the evening and were met by the Mayor, the President of the Board of Trade and other citizens. The time before supper was taken up by visits to various points in the city, a large number of the guests touring the streets in a large automobile. After supper automobiles were pressed into service and the whole delegation was conveyed east past the City Hospital, around the Public Square, via Main Street to the Erie Depot, via West Market Street to the city limits, and return. This ride gave them an ample opportunity to judge of the efficacy of the lighting system, demonstrating not only its ornamental value, as shown in the center of the city, but also its practical value in illuminating even the most remote residence streets.

To some of the visitors, who had vivid memories of fearsome drives along inky-dark suburban roads, the experience of spinning through the outlying districts of Warren over a well illuminated roadway that could be traced by the lighting units far into the distance, was both a pleasure and a revelation. Although there was no moon on the night of the excursion, the automobile headlights were used more out of deference to the guardians of the peace than as a necessity in driving.

The automobiles conveying the party on their trip around the city were supplied by the following gentlemen: Messrs. J. E. Beebe, W. G. Lamb, Col. E. E. Nash, C. E. Carey, Wm. Coale, N. H. Cobb, R. E. Gorton, J. X. Wadsworth, A. E. Mace, Judge D. R. Gilbert, C. N. Sadler, Prof. W. C. Woodland, N. A. Wolcott, A. J. Powers, Dr. Dan Simpson.

Many questions regarding the general features and technical details of the street lighting were asked by the visitors, and the desired information was furnished by members of the inviting committee, who mingled freely with the party, explaining and describing such points as might otherwise have been overlooked. The following gentlemen, several of them prominently identified with the agitation for better street lighting in Warren, were among those who played the role of mentor: Messrs. Wm. Coale, Ed. Bratton, C. O. Brandel, Col. E. E. Nash, W. George Lane, C. N. Sadler, and A. E. Mace.

Under the expiring contract of the Salem Electric Light & Power Company with the city of Salem, the company maintained about one hundred and fifty d. c. carbon arcs, on a moonlight schedule at $70 each per annum. The arc lamps have a rated consumption of 325 watts. Although it is perhaps too early to make definite predictions, yet as a result of the street-lighting excursion of Friday, July 21, there is little doubt but that when the contract is renewed it will be on quite a different basis, for the central station is taking a co-operative attitude with respect to the progressive movement that has been

* Illuminating Engineer, July, 1911, p. 255.

started. It is strongly intimated, by those who should know, that Salem will ultimately have a street lighting system very similar to that of Warren.

Another Case of Western Enterprise

Sapulpa is a little city in the midst of the wonderful oil fields of Oklahoma, there being some eight thousand wells in operation within a radius of seven miles of its City Hall. It also enjoys excellent railway facilities, being at a junction of several different lines.

The one important thing that a new Western town needs is population, and to this end it is a good business to attract attention of all who come in sight. The Sapulpa Electric Company, fired with commendable zeal to boom the city of its activities, with the certain knowledge that the value of a public utility depends upon the extent of the public utilizing it, has erected and presented to the city an exceptionally large and handsome electric sign, the legend of which and its night appearance are shown in the illustration. The sign contains one thousand five-watt Mazda lamps, and is operated by a flasher, the border being first shown, then the word Sapulpa, followed by the legend beneath, and lastly the flames over the word "Oil," bursting forth in remarkable similarity to an oil flare.

The cost of operating the sign is $75.00 per month, which is rightly considered by the citizens very cheap publicity, considering its effectiveness. In fact, so convinced are the city authorities, that they have made a ten-year contract for its operation.

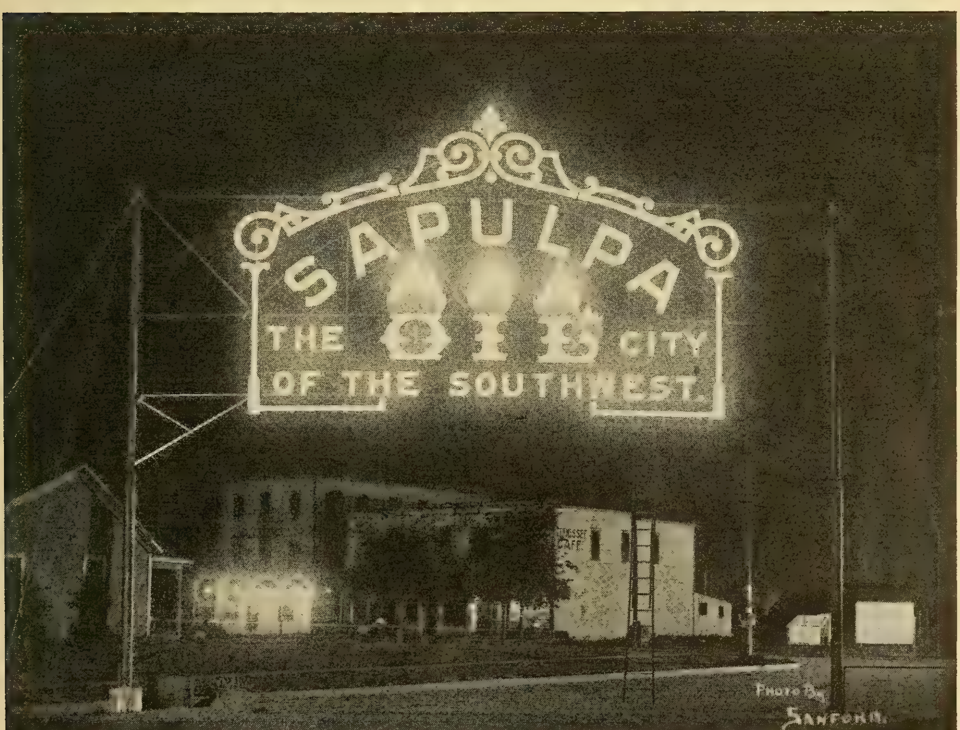


FIG I.—AN ELECTRIC CITY SLOGAN SIGN, SAPULPA, OKLA.

The Indirect System of Gas Lighting at the Remodeled Offices of the Indianapolis Gas Company

By Philmer Eves

The offices of the Indianapolis Gas Company, Majestic Building, Indianapolis, Ind., have recently been entirely remodeled and are now to be classed among the most modern and attractive gas offices in the country. The main floor, containing the cashiers' counters, the order and complaint department, the gas appliance department, and the model kitchen, have been reconstructed. The counters throughout are built of Olivo-Vermont marble with tops of Carrara white glass. The woodwork is finished in early English, while the walls are decorated in dull green with an artistic border under the ceilings. The ceiling panels are decorated in cream and gold, tinted in darker relief shades.

The general offices have been transferred to the second floor, where are also the secretary's office, the offices of the vice-president and general manager, and also a room specially arranged for the salesmen, demonstrators, etc., of the company.

Mr. Carl H. Graf, vice-president and general manager of the company, resolved to experiment with a gas lighting installation on the "indirect" or reflecting system, and equipped these second-floor general offices, the salesmen's department, the secretary's office and his own offices with fixtures having the standard upright lamps, mantles, reflector shades and canopies. This new method of illumination by ceiling reflection with gas has now been thoroughly tested and the results obtained have been very gratifying. It should,

FIG. I.—GENERAL OFFICES SHOW INDIRECT GAS LIGHTING FIXTURES (DAYLIGHT VIEW).

FIG. 2.—GENERAL OFFICES, NIGHT VIEW, SHOWING EFFECT OF INDIRECT ILLUMINATION.

FIG. 3.—ONE OF THE PRIVATE OFFICES (DAYLIGHT VIEW).

FIG. 4.—SAME AS FIG. 3, SHOWING NIGHT VIEW OF THE ILLUMINATION.

however, be explained that the successful results have been secured with the standard available incandescent gas lighting appliances. It may be possible to get even a higher efficiency with lamps and reflector shades specially designed and developed along these new lines.

The dimensions of the general office are 42 x 43 ft., and the ceiling, which is light cream in color, is 12 ft. above the floor. The floor is covered with linoleum, tan in color. The woodwork is finished in golden oak, with furniture in golden oak of dull finish, and the walls are light yellow or buff color. In this room were placed nine four-light fixtures, operating with central pilot control and chain pull, equipped with No. 71 burners, No. 196 Junior J mantles, No. 310 chimneys, No. 30 crown canopies and No. 505 silvered glass reflectors. These fixtures are placed 14 ft. apart. The consumption of gas is about 3¾ ft. per lamp, varying slightly according to the gas pressure. The distance of the mantles from the ceiling is 41 in.

The secretary's office, 30 x 15 ft., is decorated in green with the upper border and ceiling in cream color. Two fixtures, the same as used in the general offices, afford a soft and ample illumination free from shadows.

The salesmen's room is 50 ft. 6 in. x 20 ft. 5 in., and here the walls are finished in buff with lighter or cream tint on the ceiling. Three of the "indirect" lighting fixtures are found to completely satisfy the lighting needs for every part of the room.

The office of the vice-president and general manager, artistically furnished in mahogany, with the wall decoration in green with a deep buff border and light cream tinted ceiling, is 19 ft. 4 in. x 16 ft. 2 in. One four-light fixture furnishes a subdued but adequate and shadowless illumination. An adjoining room, 16 ft. 2 in. x 13 ft., also furnished in mahogany, with similar wall and ceiling decorations, is also lighted with only one four-light fixture. The carpets in this room and in the vice-president's room are green to

harmonize with the tints of the walls, and it is found that the color values under the gas illumination remain almost the same as in daylight.

After considerable experimenting with the various reflectors, it was found that the silvered glass reflector gave the best results. These reflectors are held in position by 4-in. electric shade holders which are brazed to the bunsen between the flash diaphragm and basket (see Fig. 6).

Since the adoption of this fixture for indirect gas lighting in Indianapolis a neat spun brass holder that fits the basket of the No. 71 burner and conceals the chimney and canopy, adding greatly to the appearance of the fixture (see Fig. 7), has been developed and placed on the market.

The offices in which this indirect lighting system is found to be so successful are furnished with individual desks, placed about 3 ft. 6 in. apart, irrespective of the location of the lighting fixtures, and after

FIG. 5.—TYPE OF UNIT SHOWING SPECIAL SPUN BRASS SHADE HOLDER.

FIG. 6.—SALESMEN'S ROOM, SHOWING THE NEW INDIRECT LIGHTING FIXTURES.

FIG. 7.—TYPE OF UNIT USING SILVERED GLASS REFLECTOR.

a two months' trial it has been found that with this indirect method there is an absolutely satisfactory and adequate illumination entirely free from shadows. This enables the clerks and bookkeepers to face any part of the office and have an ideal and shadowless light over their work.

The illustrations taken by daylight and when lighted at night show the distributive and excellent illumination which has been accomplished by Mr. Graf with this very interesting and instructive gas installation.

The Hygienic Value of Gas Lighting

By R. F. Pierce.

One of the greatest advantages of gas lighting, and one that strangely enough has received little or no attention, is the highly beneficial effect upon the quality of the air in illuminated interiors. As this effect is not at all obvious, but on the contrary the reverse would upon casual consideration appear to be true, it is highly desirable that the facts in the case be set forth in such a manner as to admit of the rational comparison of different illuminants in this respect. Many people carelessly and unthinkingly assume that because the burning of a gas light discharges products of combustion into the room, a perceptible vitiation of the atmosphere must result. As a matter of fact, the precise reverse is the case, and this fact really constitutes one of the greatest advantages to gas over electricity for illuminating purposes.

The combustion of gas produces from a chemical standpoint four different effects upon the air taken from the room, mixed with the gas in the burner and discharged back into the room.

These effects are:

First.—The amount of oxygen is reduced.

Second.—The amount of carbonic acid gas (CO_2) is increased.

Third.—A very small amount of sulphurous gas (SO_2) is generally added.

Fourth.—Organic impurities and deleterious substances are removed by incineration.

The first, second and third effects are caused by the oxygen combining with the carbon and sulphur contained in the gas, and this oxidizing process generates heat in sufficient quantities to raise the mantle to the temperature of incandescence—about 1500 degrees F., which is sufficient to produce the fourth effect.

The physical effects produced upon the air are:

First.—The temperature is increased.

Second.—The circulation of the air in the room is accelerated and the ventilation from the outside is increased.

As the quality of the air in the room at any time depends upon the interaction of the incoming fresh air upon the products of combustion discharged from the burners and the organic matter exhaled from the lungs and skin of the inhabitants of the room, it is necessary to investigate the inter-effects of all three.

On account of the tendency of heated air to expand, become lighter and rise, the presence of any source of heat in a room produces a certain circulation of the air, which serves a double purpose. In the first place, the heated air is cooled by contact with successive portions of the relatively cool walls, and in the second place the temperature in the upper portions of the room tends to increase, while that in the lower portion tends to decrease below that which would prevail without circulation. This produces an unbalanced pressure from the outside, tending to draw fresh air in at the bottom of the room through crevices, joints and other openings, and also to a greater extent than is ordinarily realized through the walls themselves. The same action tends to expel the air in the upper portion of the room in the same manner, and this tendency is, of course, greatly augmented by increased facilities for ventilation.

As a gas lamp produces about six times as much heat as a Mazda or tungsten lamp of equal illuminating power, it follows that the ventilating effect is correspondingly greater. At first thought it might appear that the use of gas lamps for ventilating purposes would be very inefficient and that their effect would be practically negligible. While positive assurance derived from actual installations is submitted later on, it may be well to call attention at this point to the fact that in many chemical laboratories where the air is being constantly vitiated by noxious vapors, the principal means of exhausting the contaminated air is through the use of an open gas jet placed in a suitable vent. The ventilation produced must, of course, be far more effective than that required for any ordinary purpose, as the contamination of the air is exceptionally rapid.

Of course, in making use of the ventilating properties of gas burners, a balance must be struck between the amount of radiant heat generated and rapidity of ventilation. It does not follow that the foulness of the air is always decreased by increasing the amount of heat generated in the room. This is, of course, perfectly obvious. The writer only purposes showing that under the conditions usually met in lighting practice the substitution of gas for electric lighting will generally produce this effect—other conditions being equal.

In considering the concurrent effects of light-sources and the incoming air upon the average quality of the interior air at any moment, it is necessary to inquire into the nature and effects of the vitiating substances. Generally speaking, these are divided into two classes: Those emitted by the respiration, both from the lungs and the skin of the people in the room; second, those emitted by the illuminants. The first class includes germs of those diseases which are transmitted by germs, which, when taken from the air into the system through the mouth or skin, will produce their characteristic diseases. As a matter of fact, the supposedly fresh air from the exterior is often heavily laden with germs of this character.

More commonly than any other are felt the effects of the vitiation produced by the organic matter in a greater or less advanced stage of decay exhaled by the lungs. This produces the stuffiness in a poorly ventilated room which is sometimes ignorantly attributed to carbonic acid gas.

As between gas and electric lighting, the former is the only one contributing any products of combustion whatever, and these are as follows:

First.—Carbonic acid gas.

Second.—Sulphurous acid gas.

Third.—Water.

Carbonic acid gas is present in the purest of outdoor air in the proportion of about four parts in 10,000, and produces no discomfort or ill effects if less than 225 parts in 10,000 of air are present. On account of the ability of gases to diffuse through even the tightest walls used in building construction, the proportion of carbonic acid gas in interiors rarely rises above 20 parts in 10,000, though for experimental purposes this proportion has been made as high as 50 parts in 10,000. This was accomplished only by resorting to exceptional means to secure a high percentage of this gas. Thus, practically speaking, it may be said that it is impossible in practice to obtain enough carbonic acid gas in an ordinary room to produce the slightest effect upon the bodily functions, even when the most sensitive tests are employed to detect such effects.

Sulphurous acid gas when present is in such almost infinitesimal quantities that it is disregarded by investigators, as far as effects on the health are concerned, though unscrupulous or ignorant salesmen of lighting apparatus frequently attempt to make capital of it. While it is in the quantities found entirely harmless to the human organism, it has a decided sterilizing effect as regards disease germs, which will be referred to later.

While it is true that carbonic acid gas artificially produced—that is, by gas combustion—is entirely innocuous in any quantity met with in human habitations, it must not be assumed that such quantities of this gas exhaled from the lungs, may be regarded as an indication of sanitary conditions. On the contrary, even 15 parts of carbonic acid gas in 10,000 if arising from respiration of human beings, indicates the presence of organic matter in such quantities as to be highly obnoxious or even harmful.

In this connection it should be noted that the vitiation of air by human beings is generally expressed as percentage of carbonic acid gas, because it indicates the amount of organic matter which has been given off in the same period, and while the latter (which is the real source of pollution) is difficult to measure, the carbonic acid gas is easily determined.

From a sanitary standpoint, therefore, figures regarding the quantities in which carbonic acid gas indicates harmful conditions apply only to this gas when thrown off by the lungs and not to the same gas produced by artificial means such as the operation of gas lights.

It is evident that the absurd practice of rating each gas burner as equal to a certain number of human beings in vitiating the air in interiors is not only highly ridiculous, but precisely opposite to the dictates of common sense, and the testimony of established facts, for, as will be shown later, the presence of gas burners actually removes the vitiating matter.

In order to substantiate the statements made above, the following extracts from the reports of competent authorities and experimenters are submitted.

Probably the most extensive, painstaking and intelligent reports upon the relative hygienic value of gas and electric lighting were those made by Samuel Rideal, D.Sc., F.I.C., a report of which was contributed to the *Journal of the Royal Sanitary Institute,* published in Volume XXIX, No. 2.

This investigation was carried on over a considerable period of time in a room provided with both gas and electric lights, the former from inverted incandescent burners and the latter from incandescent electric lamps.

These experiments were made in an office building at No. 28 Victoria street, London, in a room 29 ft. 9 in. by 16 ft. 4½ in. by 10 ft. 4 in., and covered a considerable period of time. Exceptional pains were taken to see that the inmates of the room were all healthy and could be classed as fair physiological examples of men living and working in London, and every care was taken to exclude those afflicted with transient catarrhal or other symptoms likely to affect the results of the experiment. The experiments covered a wide range of conditions, and the tests included frequency and character of pulse, as shown by the sphygmograph, frequency of respiration, arterial blood pressures, variation in the number of blood corpuscles, body temperatures, body weight, mental fatigue, eye fatigue, time reaction, etc. The physical and chemical determinations included the change in temperatures, due to the different illuminants, rapidity of ventilation, content of carbonic acid gas, number of bacteria, amount of organic matter, relative humidity, etc. The amount of gas consumed and its calorific value was carefully determined, as well as the input of the electric lamps. The illuminating power of the gas burners was considerably in excess of that of the electric burners as was determined by photometric test. This report comprises over 80 pages, and in the limited space available here it is obviously impossible to reproduce the data with sufficient entirety for the reader to criticise or analyze it satisfactorily. The following extracts from the summaries of this investigation are given herewith.

The following table gives a summary of the average temperatures at the beginning and end of the runs:

Arrangement.	Gas. No. of runs.	Gas. Degrees F. Initial	Final.	Rise.	Electric. No. of runs.	Electric. Degrees F. Initial.	Final.	Rise.
Restricted ventilation:								
*Undivided room..................	22	53.6	57.0	3.4	18	54.0	57.2	3.2
Divided room.....................	6	59.0	63.4	4.4	6	58.7	62.9	4.2
Fireplaces and ventilators open:								
Divided room.....................	2	60.8	63.9	3.1	2	59.2	62.7	3.5
Fireplaces, ventilators, doors and windows open:								
Divided room.....................	2	58.4	57.5	−0.9	2	58.3	56.9	−1.4

* During the series of experiments, the room was divided into two equal and symmetrical parts by a wooden partition in a number of the tests.

The results of these tests show plainly that the difference between gas and electric light on the temperature of the room was negligible.

As regards the presence of organic matter in the air, the figures below are expressed in volumes of oxygen consumed per million volumes of air for the oxidation of the organic matter:

	Air outside.	Room. 5.45 p.m.	Room. 9.00 p.m.	Rise.
Undivided room:				
Average total......	2.8	4.9	8.8	..
Average total gas...	..	5.3	9.0	3.7
Average total electric	..	4.0	9.8	5.8
Divided room:				
Gas	..	..	..	2.7
Electricity	..	..	..	4.7

Thus the increase under electric lighting during the day in the undivided room was about 50 per cent. greater than that under gas light. In the divided room the increase under electric light over gas light was somewhat greater. As regards the bacterial contents of the room, Dr. Rideal stated that the following factors would all tend toward lessening the bacterial content with gas lighting as against electricity:

First.—The cremation of organisms in the flames.

Second.—The sterilizing effect of the sulphur acids in the gas.

Third.—The increased condensation on the cold surfaces, removing organisms as well as the sulphur products.

Fourth.—Any increased ventilation of the room.

The organisms falling by gravity and air currents were determined by the exposure of nutrient gelatine plates for a definite time in various positions in the rooms, and a reduction of 29.2 was obtained under electric light, as against 35.3 under gas light. Obviously, in this test the ventilation was a most important factor, as these organisms were for a great part deposited upon the plates before having an opportunity of passing through the flames of the gas burner.

Another test was made of the organisms per cubic centimeter in the condensed moisture. The following table sets forth the results of this test, showing that while the sterilization of the air passing through the gas burner was entirely complete, no such sterilizing action existed under electric light:

ORGANISMS PER CUBIC CENTIMETER IN CONDENSED WATER.

Electric Light. Date. 1907.	Start.	Finish	Persons in room.	Gas Light. Date. 1907.	Start.	Finish.	Persons in room.
February 6.............	12	15	8	February 11.............	4	0	8
February 18.............	26	18	8	February 15.............	6	0	9
February 26.............	..	9	1	February 27.............	..	0	4

It may be well to call attention to the fact that at this point that the condensed moisture carried but a small percentage of the bacterial organisms into the air, and while the entire absence of such organisms in the condensation under gas light would indicate a very complete sterilization of the air, it by no means follows that the number of organisms present in the water condensed under electric light give a very satisfactory indication of the number of organisms existing in the air, as only a small portion of the bacteria would be found in the condensed water.

As regards the ventilating effect, it was found that the percentage of carbonic acid gas was practically the same for both gas and electricity, showing that the gas burners have sufficeint power to produce a ventilation adequate to remove the excess of

carbonic acid gas produced. With ordinary ventilation the excess disappeared entirely, while with the poorest ventilation the slight excess of carbonic acid gas under gas light was practically negligible:

CO_2 PARTS IN 10,000 DURING STEADY STAGE.

Divided room.	Gas.	Electric.
Fireplaces and ventilators closed	41.1	31.1
Fireplaces and ventilators open	19.4	19.3
Fireplaces, ventilators, doors and windows open	8.7	7.2

In the general summary, Dr. Rideal stated that gas burners give rise to stronger air currents and invariably produce a more active ventilation and diffusion of air than electric lights; hence, along with the products of the gas burner, the exhalations of the persons present were more rapidly removed. Second, the ascending currents of air from the gas lights on reaching the ceilings rapidly parted with their heat which was conducted away by the rafters and joists. Third, the electric lamps produced more heat than is commonly accredited to them, and that this is the explanation of the unexpected result that the average temperature of the room was practically the same under either illuminant, and that the electric light did not show the superiority in coolness usually claimed.

While the careful and exhaustive tests of Dr. Rideal would appear to be most convincing as regards the absence of the obnoxious products sometimes ignorantly attributed to gas burners, it may be worth while to note, for the benefit of the ultra-skeptical, that nearly all competent authorities agree that even if the CO_2 contents of the air were increased (*which is not the case*) such increase could not produce ill effects.

Dr. Angus Smith shut himself in an air-tight chamber with a lighted candle, and remained until the candle was extinguished by the high CO_2 content produced (229 parts in 10,000). He felt no ill effects.

Dr. Richardson removed all the CO_2 from air that had once been breathed, and found that animals introduced into such air dwindled away rapidly and died.

Pettenkoffer found that 100 parts of CO_2 in 10,000 parts of air was not injurious to human beings, while one-tenth the amount of CO_2 derived from lung and skin exhalations rendered the air unfit for human habitation for any length of time.

Proof of a similar nature from the experiments of recognized authorities might be multiplied almost indefinitely.

It would seem, therefore, that the bugaboo of increased CO_2 content from gas burners may not only be said to exist only in the imaginations of interested exploiters of competitive illuminants, but, furthermore, if it did exist, would be perfectly harmless.

Another feature of even greater importance is the effect upon the eye. This subject has been carefully avoided by the antagonists of gas lighting with that discretion which is the better part of valor.

As the really great problems of illuminating engineering have to do principally with the conservation of vision, Dr. Rideal's conclusions on this score will be briefly mentioned, though deserving extended comment and analysis.

"(a) The sensitiveness of the eye to light as measured in the Perception test diminished very markedly after exposure to the electric light, while no corresponding effect is noticeable after the eye has been subjected to gas light.

"(b) The power of co-ordinating and using the motor muscles of the eyeball recorded in the orbicular muscle tests was diminished to a greater extent after subjection to electric than to gas light.

"(c) It was found that the ciliary muscles of the eyes are more accommodative after three hours' exposure to the 50 c.-p. light from the Darwin incandescent mantle than after a similar exposure to a 50 c.-p. electric light.

"(d) The acuity of vision measured by the retinal test again shows that the optic nerve or center was more susceptible in the case of gas illumination. It will be seen that all the results point strongly in the same direction—namely, that gas light as used in these experiments is less fatiguing to the eye than electric light."

It would appear, therefore, that in calling attention to the alleged shortcomings of gas lighting from a hygienic standpoint its antagonists have only succeeded in shifting the burden of proof of *absence* of unhygienic qualities upon their own shoulders.

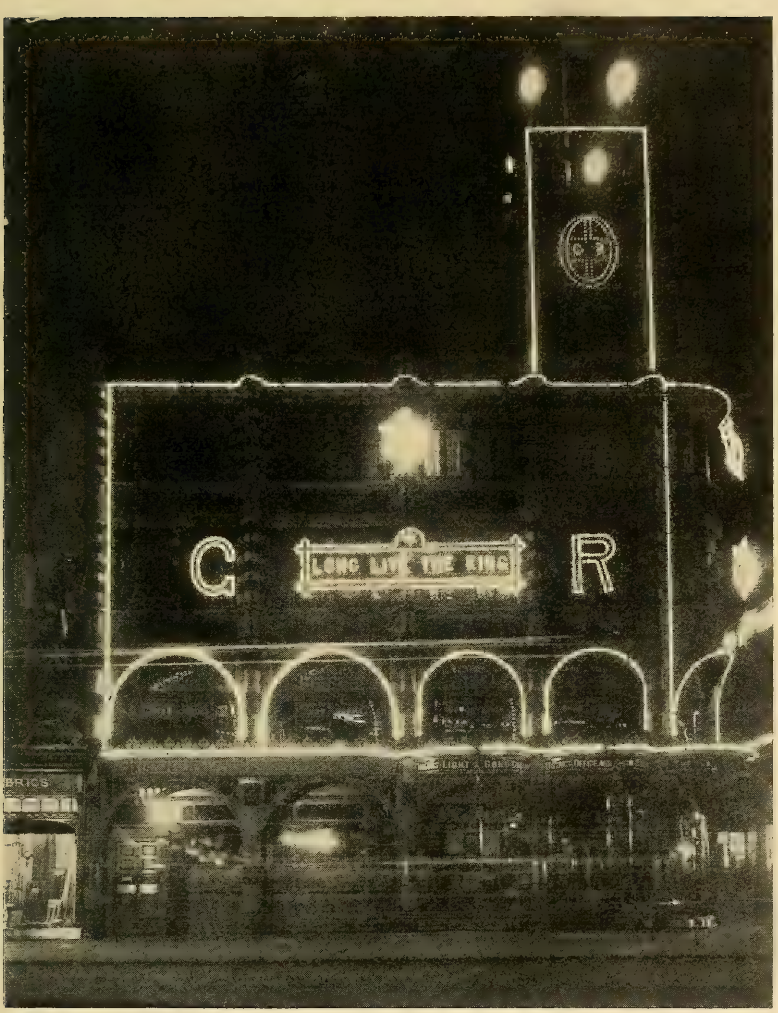


FIG. I.—GAS ILLUMINATION DISPLAY, GAS LIGHT AND COKE COMPANY'S BUILDING.

Spectacular Illumination in London in Honor of the Coronation Ceremonies

It has been said that the conditions for producing a great oration are the occasion, the subject and the orator. The oration and the ode have lost their preeminence as the crowning glories of national festivities, and in their place has risen spectacular illumination. Of all the numerous events that made up our own Hudson-Fulton Celebration, who remembers to-day what any one said or wrote about the historical incidents that were celebrated? Can you yourself even mention the name of a speaker? As to the coronation festivities in London, which are only a few days past, will they leave any literary mementoes that will outlive the newspaper reports of the day? In such festivities we now go out to see rather than to hear. Likewise the participating public expresses itself through outward and visible signs rather than in spoken or written words, and by far the

FIG. 2.—ILLUMINATION DISPLAY, SOUTH METROPOLITAN GAS CO.'S OFFICES.

most conspicuous element in these signs is light. A study of the illuminations, therefore, is of more than mere technical interest.

We can manifestly only glance at a few of the more typical examples in the limits of this article. In order to arrive at definite ideas the mind involuntarily compares similar impressions; and the American spectator or reader will naturally compare the coronation illuminations in London with those of the Hudson-Fulton celebration in this city. While both were national events, the chief theatre of the celebration was the metropolis in their respective countries.

Two general impressions will probably be common to all observers; first, that the London illuminations were less spectacular in their nature, and, second, that gas light played an important part in the general scheme. For instance, there was nothing to compare with the gorgeous magnificence of the enormous battery of searchlights and steam jets, which illuminated the heavens above and the land and water beneath, that formed the most notable and original feature of the Hud-

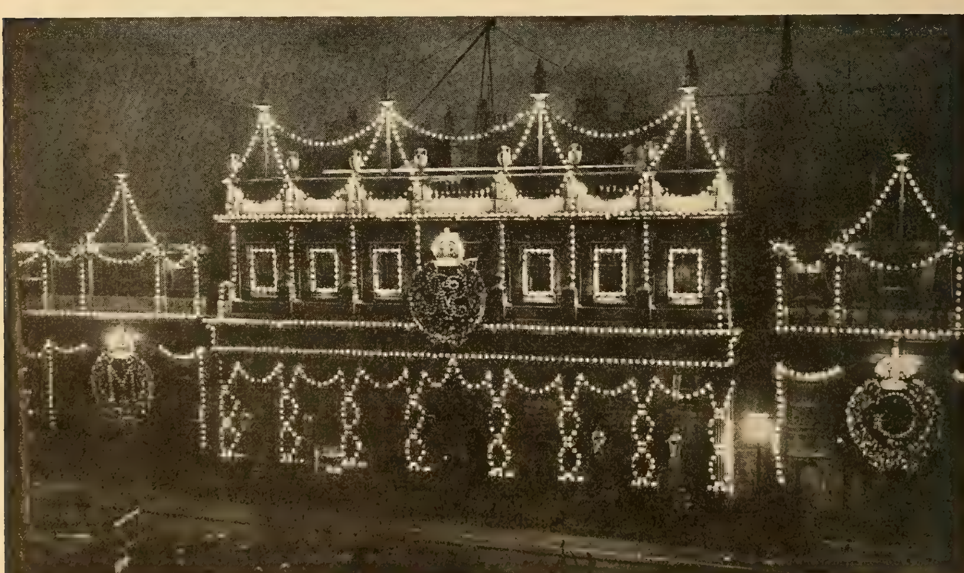


FIG. 3.—THE BANK OF ENGLAND.

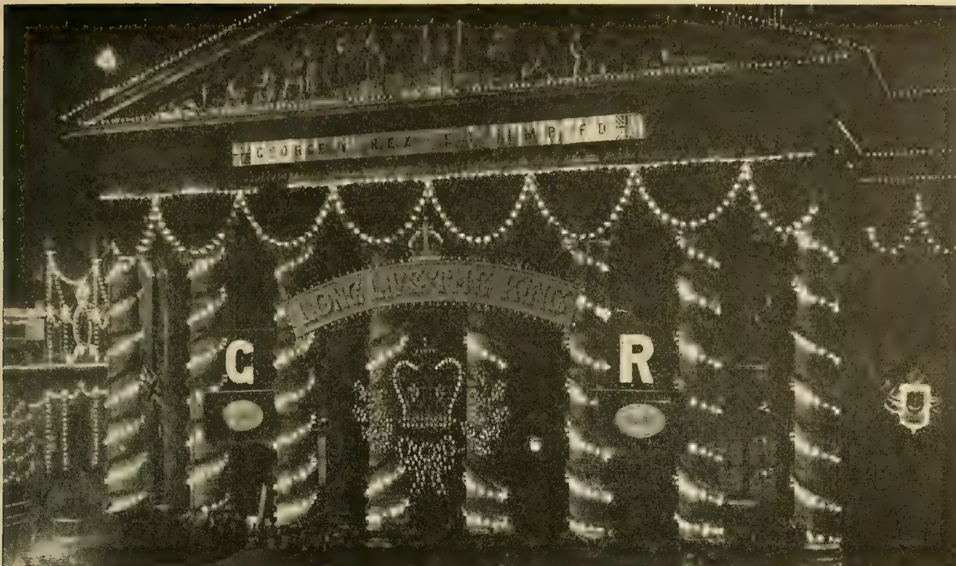


FIG. 4.—THE ROYAL EXCHANGE.

son-Fulton illuminations. On the other hand, there was apparently a greater display of refinement in the devices than was shown in this city. Frosted and tinted electric lamps were largely used, often in combination with floral and other decorations. While no figures are given, there is little doubt that we consumed vastly more electric current during the Hudson-Fulton week than was consumed in London during the coronation week, and this, to many an American, will probably be taken offhand as proof positive that our own illuminations were superior. This does not necessarily follow, however. Illuminations can hardly be better measured by an electric meter than can an art exhibit by a yard stick. Certain it is that the London illuminations were in excellent taste and of a high order of artistic merit.

The use of gas flames for elaborate exterior illuminations was far more than a mere "stunt" on the part of gas companies to show their teeth in their own wares. Some of the finest effects were of this character; and while the difference cannot be adequately shown by a photograph, it requires no great stretch of the imagination to picture the peculiar attractiveness which a living flame possesses over a fixed luminous source.

Fig. 1 shows the illumination of the offices of the Gas Light & Coke Co., the largest producers of illuminating gas in the world. The outlining and mottoes are with gas jets, while at the four corners of the tower are huge flames or torches.

Fig. 2 shows the offices of the South Metropolitan Gas Co. As a successful piece of outlining and luminous decoration this will certainly bear comparison with any electrical effect yet shown. The gas torches along the cornice add the spectacular element that could scarcely be equaled by any other means.

The Bank of England is a building that, according to European notions at least, should have a peculiar attraction for Americans. This is shown in Fig. 3. Five thousand lamps were used in the installation.

The front of the Royal Exchange is shown in Fig. 4.

A corner of the Selfridge store, which represents an effort to transplant the American department store to the heart of London, is shown in Fig. 5. As will be noted, the decorations are exceedingly handsome and free from all attempts at the gaudy, while ample use is made of small electric lamps.

The British Thomson-Houston Co. offices were illuminated as shown in Fig. 6.

White's Club is shown in Fig. 7. This is an excellent piece of decorative lighting which possessed the novelty of having the electric lamps all concealed. Tubular tungsten lamps in special reflectors were used for the purpose. This set off the beautiful floral decorations to the best possible advantage, and was a conspicuous feature in distinction from the general scheme of display lamps.

Some of the other notable installations are thus described in the *Morning Post:*

A more ambitious scheme has been adopted at Dorchester House, the home of the American Ambassador. Every architect-

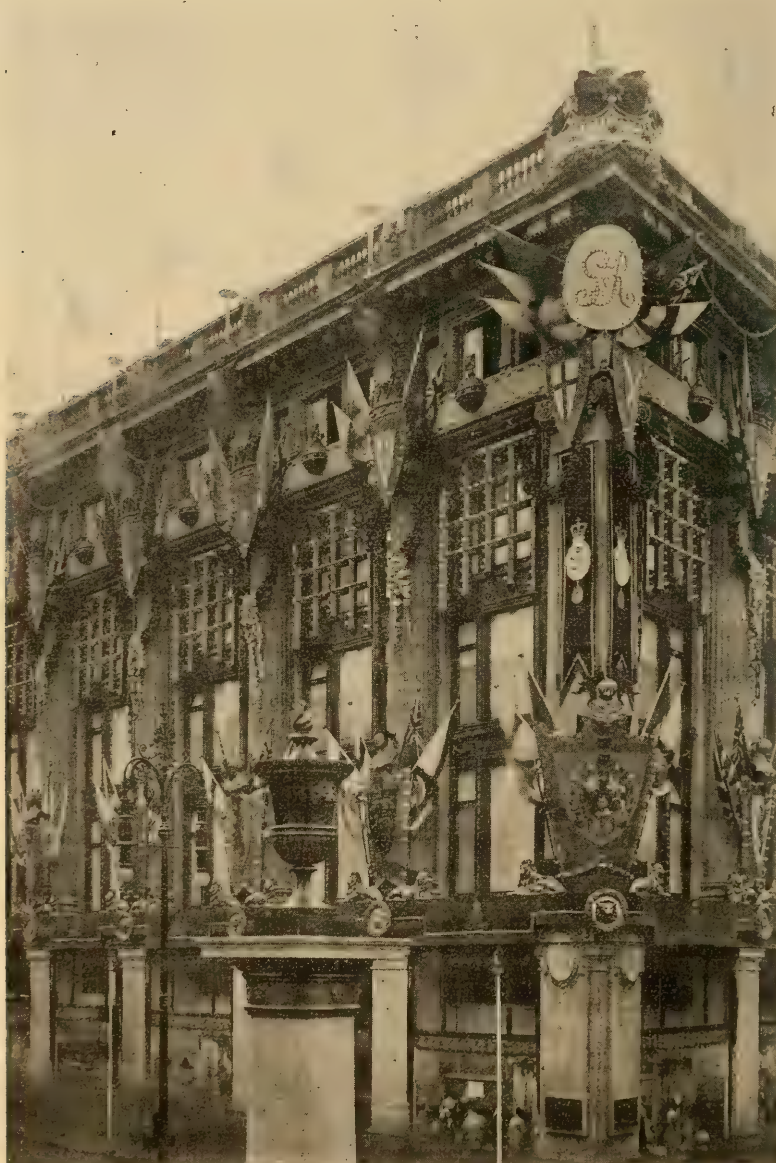


FIG. 5.—SELFRIDGE'S AMERICAN DEPARTMENT STORE.

FIG. 6.—THE BRITISH THOMPSON-HOUSTON CO.'S OFFICES.

ural feature—cornice, window-frames, and pillars—has been outlined with electric lights, and the result is to present the building in its barest skeleton, so to speak, but without destroying any of its distinctiveness. On the Park-lane side of the house are two illuminated stars, with the Royal initials G. and M. between them, and an Imperial crown in the centre. At the corner of the building is a large electric shield of flags, in which the Union Jack, the Stars and Stripes, and the Cross of St. George are combined. Lower down Park lane a pretty picture is presented by the illuminated houses on the two sides of Great Stanhope street, and, at the far end, the festoons of lights on Chesterfield House. Londonderry House is also illuminated.

Not only in London and in all the cities and towns, villages and hamlets was night turned into day and festivity reigned supreme; but from mountain tops and lesser heights, and common lands in all parts of the United Kingdom, beacons and bonfires flared in consonance with the rejoicing of the people. Not always were beacons fired for such purpose. Three hundred years ago they were a sign of oncoming national danger. Last night, from Land's End to John o' Groats, from Lowestoft to Milford Haven, and in many parts of Ireland some three thousand fires proclaimed national gladness.

"A most beautiful display may be seen at the Automobile Club, which is decked out in all the brilliance of summer flowers, wreaths and electric lights. The pediment bears a huge Imperial crown, supported by G and R, while at each extreme of the façade hang three laurel wreaths bright with electric lights. Many festoons of laurels and lamps hang from various points, and the crimson and silver gray hangings are in many instances edged with strings of lights. The Oxford and Cambridge Club has confined its colors to light blue and dark blue, and wonderfully good use has been made of these simple elements in decorating and illuminating the premises. Many of the insurance offices, notably the Royal Exchange, are a blaze of color, and on the building occupied by Messrs. Barclay and the Atlas and Standard Assurance Company runs the legend, 'George, King and Emperor.'"

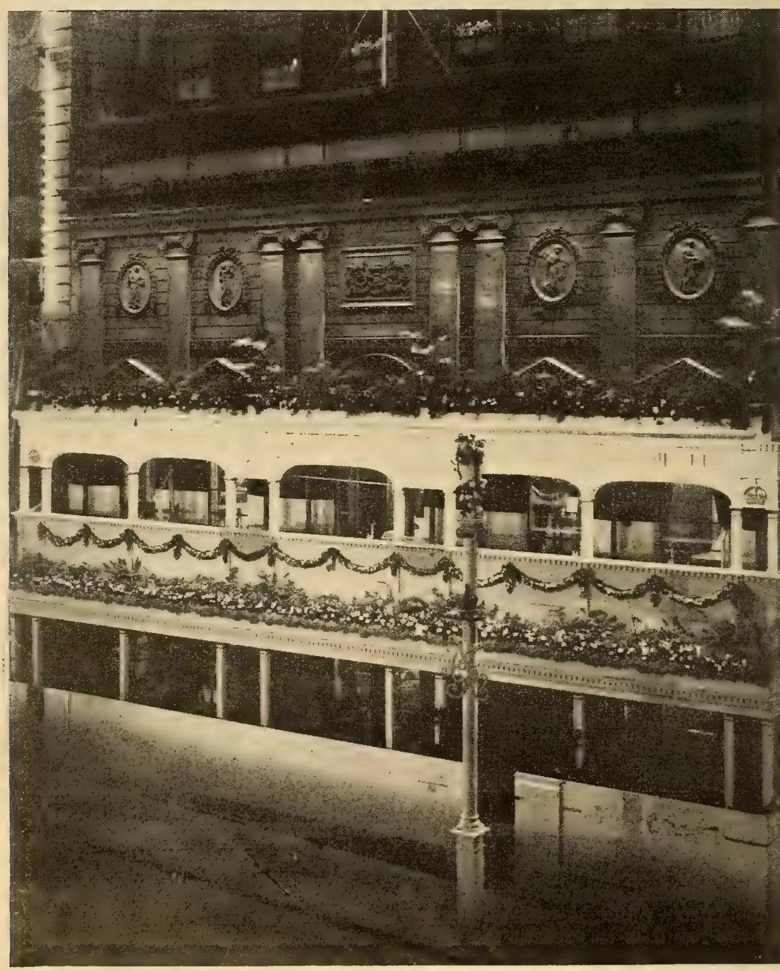


FIG. 7.—WHITE'S CLUB, ST. JAMES STREET.

Fixtures and Accessories

A New Idea in Portable Lamps

FIG. 1.—AN ANTIQUE DESIGN.

In a previous issue we referred to the availability of pottery as a material for portable lamps and illustrated some very pleasing effects produced by a well-known American pottery.

It is always a legitimate occasion for pride to be able to chronicle an achievement consummated in our own country along lines in which we have previously had to admit our shortcomings. The development of the potter's art in the older countries of the world, and particularly the oldest whose civilization is still an important factor in the world—China—has until recent times quite overshadowed our native productions. The American, however, boasts, not without good reason, that when he does undertake to do a thing he does it " to a finish," and in record time. A justification of this boast may be found in the remarkable progress made by American potters within the past few years.

The latest exploit in this direction comes from the oldest pottery in America, which has been in continuous operation for over one hundred years. During its century of existence, with the exception of the last three or four years, this pottery pursued the even tenor of its way, turning out bowls and jugs whose reason for existence lay in their usefulness as containers of vinegar and molasses and pastry cooks' concoctions. From plebeian ware of this kind to suddenly take a place among the art treasures of royalty and wealth was certainly stepping from the ridiculous to the sublime; but the step, which is traditionally a short one, has been taken. The saying that " beauty is only skin deep " applies with literal truth to pottery; the highest art may exist only in the thin superficial glaze given to a background of the most ordinary clay. This is the case in the present instance. The same clay that had been finished into many a mixing bowl has been given a more

FIG. 2.—A STUDY FROM OLD CHINA.

esthetic shape and finished with a surface, or glaze, which in some cases is the rediscovery of effects produced in China so long ago that they have become a lost art even in their own country.

While a variety of artistic glazes of the highest merit are found in this new ware, there is combined with the revival of methods thousands of years old a most ingenious Yankee device for combining the latest accessories of the electric light. Furthermore, the useful purpose of the lamps has not been entirely subjugated to artistic effect. The lamp is complete in two parts, the base and the shade, both of which are of thick pottery. The top of the base, or standard, is made to receive a Benjamin cluster holding the desired number of lamps, and a Cutler-Hammer push switch is inserted in the base, its

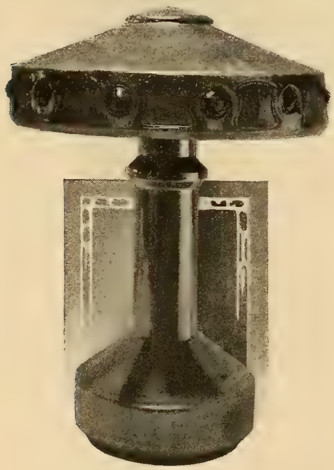


FIG. 3.—ANGULAR BUT ARTISTIC.

only evidence being the small, protruding ebony button. The shade rests directly upon the standard, and is perforated in various designs, the perforations being filled in with colored glass jewels or placques. The under side of the shade is given a matt white surface, which forms an excellent diffusing reflector.

The total effect is absolutely unique, some of the pieces appearing actually archaic in the simplicity of their art and possessing the element of fascination which attaches to the very ancient. Fig. 1 is, perhaps, the best example of this

FIG. 4.—A HARMONY OF GRACEFUL CURVES.

kind. The finish is in varying shades of matt green.

Fig. 2 is dintinctly Chinese in its motive, the base having the form of the ancient jug, and the shade a correspondingly simple form. There is no incongruity here, since the base might readily be conceived as a container of oil to supply the illuminant. The finish in this case may be one of the ancient Chinese glazes, such as blue or pink, or it may have the matt green or yellow.

FIG. 5.—ART NOUVEAU.

FIG. 6.—SIMPLE BUT EFFECTIVE.

Fig. 3 shows an angular design which becomes artistic notwithstanding its severe outline, by reason of the decoration of the shade and the antique finish given to the surface.

Fig. 4 is a design in which the contour has been given a graceful sweep of curves, the inlaying in the shade being of a design to correspond.

Fig. 5 is a design which shows Art Nouveau motives. The peculiar artistic qualities of the material thus appear to run the whole gamut of motives, from the prehistoric to the latest school of art.

Fig. 6 is a design which is very simple in contour but well balanced and pleasing in its effect.

Fig. 7 amply fulfills the requirement that the base shall be sufficient to support the shade. Its breadth of horizontal line would render it especially suitable for low ceiling rooms.

Fig. 8 is a thoroughly practical table lamp having a much higher standard, and a shade so formed as to give a fairly wide distribution of light beneath.

FIG. 7.—FOR THE LOW-CEILING ROOM.

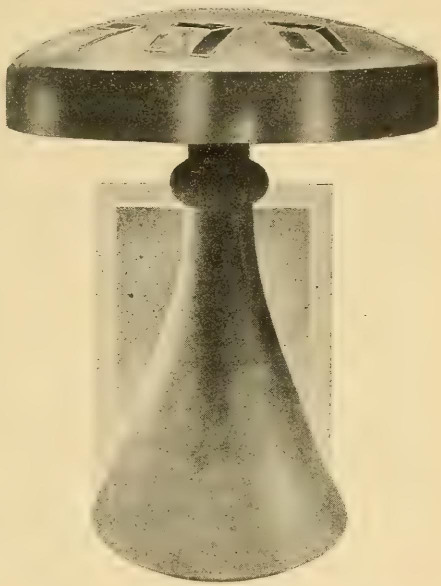


FIG. 8.—BOTH PRACTICAL AND DECORATIVE.

It would be manifestly poor art to attempt any superficial plastic decoration in this form of pottery; the artistic value depends upon simple but well balanced contour curves, and the peculiar beauty and effectiveness of the glazes used in the finish. There is a certain amount of severity in the designs which may form a pleasing contrast with more elaborate surrounding decorations. This severity, moreover, conforms to the demand that the lamp shall be a light giver as well as an object of art.

Protecting the Eyes of School Children

The first week of September will see several million boys and girls, between the ages of five and twenty-one, take up their work in the public schools of the country. The number in New York City alone will reach about three-quarters of a million, and in other cities in proportion to the population.

Many States now require a certain amount of school attendance by law, the State thus assuming bodily control of the child during a portion of its life. In thus assuming control of the persons of these children the State necessarily becomes responsible for their welfare, physical as well as mental and moral, during this period. The theory upon which the Government assumes this control is that such action will conduce to the preservation and welfare of the social order which it represents; it is therefore in duty bound to turn back to the parents and public a better product than it received, otherwise it has failed in its purpose and should cease to exercise authority.

Since physical health is admittedly the first and most essential element in the welfare of a human being, any impairment of this due to conditions arising from State control of the individual is a crime on the part of the Government. In order to avoid impairment of health it is necessary to know in the beginning the general physical condition of the pupil. Where there are physical defects due account must be taken of them to prevent their aggravation and to remove them as far as possible.

Of all the functions demanding attention among school pupils that of vision is beyond question the most important. The problem of properly caring for the eyes of public school pupils is one which demands the most careful and systematic attention. The normal eye of the child is readily injured by improper use and other work, and natural imperfections may readily become aggravated to the extent of total loss of sight. Adequate care of the eyes of pupils requires thorough examinations at regular intervals, not less than one year apart, and insistence upon proper medical treatment of diseased eyes and the careful fitting with glasses of those that are optically defective.

Furthermore, every condition affecting vision should be the best possible under the circumstances. Daylight illumination should be sufficient in quantity and of the best quality, and the same should hold with artificial lighting. While the latter is not a serious problem in the smaller towns, it is of vital importance in the large cities, especially in the congested districts.

The amount of close eye work required in the way of book study should also be carefully graded according to the age of the pupil.

The character of text books, blackboards, maps and other objects of vision must likewise be duly considered. The Association of Women Principals of the Public Schools in New York City has had a number of these questions under consideration, assisted by a board of eminent oculists. Their investigations resulted in the following suggestions, which were directed to the Board of Education:

Suggestions.

1. That hereafter no calendared or coated paper be permitted in the text-books given

to the children, as the dazzle of such paper is injurious to their eyes.

2. That half-tone pictures be not permitted in school books, but that simple, easily seen, outline pictures be substituted for them.

3. That the length of line in school books be from a minimum of 2¼ in. to a maximum of 3 in.

4. That the space between lines be not less than 3 m.m.

5. That in reading the children hold their books at an angle of approximately 45 degrees, and that in oral reading they be required to look up frequently.

6. That after a lesson demanding close work the children be asked to look up at the ceiling or out of the window to change the focus of their eyes and rest the muscles of accommodation.

7. That classrooms be equipped with loose chairs of different sizes so that the children may sit in seats that fit them, placed where they can see best.

8. That in the first two years of school all writing be upon blackboards instead of upon paper.

9. That all rooms in which artificial light is burned continually be closed.

10. That no part-time classes be permitted to occupy any room in which the light is not entirely satisfactory.

11. That electric bulbs used in lighting classrooms be made of frosted glass, and that clusters of such bulbs be provided with pale amber shades to screen the pupils' eyes from the direct rays of light.

The propriety of these rules is in the main sufficiently evident to the layman. There are two points, however, upon which there might be some difference of opinion. The suggestion that children look up at the ceiling or out of the window to rest the eyes is not clearly evident. The windows are the most brilliantly illuminated area in the schoolroom, and the ceiling generally white and the next most brilliant surface. While looking into the distance changes the focus of the eye, looking at a window would necessitate a change in the pupillary opening, while looking at the ceiling requires an unnatural movement of the eyeball. It would seem a much more effective method to simply close the eyes and place the hands over them, thus giving them absolute rest. This is something that we do involuntarily when the eyes are strained by overwork.

The use of frosted electric lamps is, of course, an improvement over the clear bulb, but even this and the use of amber shades is inadequate to produce a sufficient diffusion and softening of the light. As a general rule it should be required that some means of diffusion be used which will entirely hide the form of the radiant.

While the care of the eyes of school pupils has been generally neglected, it is encouraging to note a very decided awakening on the part of school authorities and the public in this matter. The committee appointed last year by the National Educational Association to consider the whole subject has made a preliminary report, and will continue its work in co-operation with the American Association for the Conservation of Vision and report further at the next convention of the National Educational Association.

Shadow Effects in Indirect Illumination

Before indirect lighting had attracted any considerable attention the absence of shadows in illumination was not infrequently dwelt upon by commercial illuminating engineers as a valuable accomplishment and a distinct virtue in a lighting installation; but when indirect lighting began to be an appreciable factor in the lighting field, it was discovered that shadowless illumination is a snare and a delusion, and that it constitutes the fatal weakness of this system. The statement was pure assumption, but it sounded plausible and so gained much credence without question.

For centuries people believed that bodies dropped from the same height would fall with a speed proportionate to their weight; it seemed as if they ought to. But it finally occurred to the Philosopher Galileo to try it, which he did by dropping two stones of different sizes from the top of the leaning tower in Pisa. It transpired that the stones had the indiscretion to reach the ground at the same time—which, of course, they ought not to have done; evidently a case of the perversity of matter.

The reiteration of the statement that indirect illumination is shadowless by Mr. Haydn T. Harrison, in England, induced Mr. Justus Eck to resort to Galileo's disconcerting method, and try it by the convincing proof of the photographic camera. A room devoted to modeling and similar artistic work was chosen for

the experiment, the illumination being produced by an inverted arc lamp suspended from the ceiling. Mr. Harrison had stated that a sphere under indirect lighting would appear like a disk owing to the absence of shadow, and by inference other objects would be equally lacking in perspective and relief. The photograph completely refutes this contention; a disk and sphere of the same size suspended from the ceiling show their respective characters with perfect distinctness, while the full perspective and detail of the various busts and statues is preserved with equal fidelity. Careful measurements of surface brightness in various parts of the room with the Dow illuminometer show that the contrast in light and shade is almost exactly the same in indirect lighting and daylight.

These instructive and valuable experiments are in entire accord with our statements on the subject in a previous issue, and should put a quietus on this theoretical fallacy.

Reported Dissolution of the "Lamp Trust"

According to the newspapers—and, of course, if it is in the newspapers it must be true—the "lamp trust" has followed the example set by the coon in its encounter with Davy Crockett, and has agreed to come right down if Uncle Sam will refrain from further shooting. In other words, having accepted the inevitable, the "combination" has agreed to dissolve without further litigation.

Just what this will mean to the business of manufacturing and selling lamps and to those who purchase and use them, remains to be seen. Since the personal management both of the business and manufacturing ends of the several companies has remained undisturbed during the whole period of the alleged illegal combination, it would seem that there would be very little, if any, disturbance in the conditions that have been so productive of success during the past. Trust busting has not yet gone so far as to prohibit the co-operation of manufacturers looking toward improvements in their product and in the methods of cheapening the process of manufacture. The splendid engineering laboratories and corps of investigators, which was one of the conspicuous results of this combination, will doubtless continue their labors unabated and unhampered to the benefit of all users of electric light as well as the manufacturers who support the work. The results already achieved in the line of social betterment of the operatives and other employees and the elaborate plans that had been made for its future extension are matters which it would be a great pity to have thwarted.

Of course, the effect upon price will be the principal thing observed and commented upon by the public; but to the more thoughtful class of consumers the ultimate effect upon the quality of and improvements in electric lamps will be watched with much deeper interest. If unrestrained competition finally results in the cutting of quality in order to cut price, which has uniformly happened heretofore, the second state may well be worse than the first. The average consumer is not averse to paying a fair or even a high price for a good, dependable article; the thing that he does really kick against is getting a distinctly inferior article, no matter what the price.

No thinking or right-minded person will deny that the combination of manufacturers may be a great power for good. To eliminate the evils and the abuses of the power of combination without encroaching upon the good which is accomplished seems as difficult a task for the legal trustbuster as for Shylock to cut out his pound of flesh without spilling blood.

All social progress, however, has proceeded as a wave motion, the plane of equilibrium or justice occupying only an imaginary position between the trough of abuse and the crest of reform. Just at present the judicial putting asunder of what man hath laboriously joined together seems to be approaching the crest of the reform phase of the wave. Just what the next trough of abuse will be is difficult to foresee; the only thing sure is that in its progress the wave will reach such a stage.

A New Scheme for Obtaining an Absolute Unit of Light

It is a curious contradiction in science that while light furnishes the only absolute standard of physical measurement in

existence, viz., the unit of length, there has been no absolute unit for measuring light, *i.e.,* we have no method of measuring light in terms of the fundamental units of length, mass and time. The unit of mass is derived from the unit of length, so that in reality there are but two absolute units—length and time. As the metric system is the basis of scientific calculations, the centimeter is the unit of length, the gram the unit of mass and the second the unit of time. These fundamental units are familiarly referred to by the scientist as the " C. G. S. system."

The discovery of a method by which the fundamental unit of length could be determined without comparing it with any other actual distance, as comparing one yard stick with another, has been the object of an enormous amount of scientific inquiry, both privately and on behalf of various governments. An effort was made to refer the English yard to the length of a pendulum vibrating once a second under given conditions. Experience proved, however, that it was nothing but a beautiful theory and incapable of affording the absolute unit designed, owing to difficulties in carrying out all of the conditions.

Then the French Government tackled the problem and defined their unit of length, the meter, as the ten-millionth part of a quarter circle of the earth. This was accepted for some time, when the refinement of physical measurements showed that the meter in actual use differed measurably from the theoretical distance, and that the definition was useless for practical purposes.

More recently the solution of the problem was again undertaken by a commission of scientific experts, and, strangely enough, the inconceivable minute distance represented by the wave length of light was found to furnish a practical method of arriving at a definite length without reference to any other distance. Thus, all physical quantities, except that of time, which can hardly be called a physical quantity, are measured by units derived from light, and this one exception is the measurement of light itself.

Probably even more effort has been made to arrive at a method of obtaining an absolute measurement of light than of securing a fundamental unit of length, but thus far without success. The latest method to be proposed comes from Dr. R. A. Houstoun of the University of Glasgow, who sets forth his proposition in a paper contributed to the Royal Society. The principle of his scheme is as follows:

Light being a form of energy, its absolute measurement must be expressed in the fundamental unit of energy, the erg, which unit is derived in accordance with the C. G. S. system. An idea of its meaning may be obtained by considering it a very small fraction of a horse-power, since it is a measure of the same kind of quantity. Light falling upon a surface represents the expenditure of a certain amount of energy measurable in ergs per unit of surface.

In order to have such a measurement express the visual intensity of illumination two conditions must be complied with: first, all of the energy of the rays accompanying light, but which do not produce vision, commonly spoken of as ultraviolet and infra-red rays, must be eliminated from the measurements, and, second, the relation between the physical energy of the visible rays and their effect in producing vision must be determined.

It is well known that various transparent substances have the ability to absorb the so-called invisible rays. Solutions of certain chemicals afford a practical means of securing filters or screens which will cut off these rays while transmitting those that produce vision. This solves the first problem.

The energy of the remaining waves, which represent visible light, may then be measured by means of a thermopile, which is an apparatus that will generate electric current when heat or other radiant energy falls upon it and measuring the current thus generated by a delicate galvanometer. Since galvanometers are susceptible to almost infinite sensitiveness the measurement can be made with a high degree of accuracy.

Theoretically, the intensity of illumination should be in proportion to the current generated. A comparison of the visual and electrical methods of measurement showed this to be the case, and also afforded a means of establishing the relation between the two.

Aside from furnishing an absolute unit

for the measurement of light, this method also eliminates the question of color, the "Purkinje effect," and personal idiosyncrasies of vision.

Professor Houstoun proposes the following as the definition of the unit and intensity of light:

"The unit of light intensity is that source the total intensity of radiation from which at an optical distance of 1 meter after passing through an ideal filter would be x ergs per square centimeter per second; the ideal filter to be one possessing the light absorbing properties of a 3 cm. thick aqueous solution of crystallized copper sulphate, of strength 0.200 gramme molecule per liter and a 1 cm. thick aqueous solution of potassium bichromate of strength 0.0025 gramme molecule per liter; but neither to reflect nor to absorb any light in any other way."

The Illuminating Engineering Society Convention

This is the last call to those who expect to attend the sixth annual convention of the Illuminating Engineering Society; likewise to those who have not yet decided whether to go or not. The fall crop of conventions is ripening for the harvest, which promises to be an abundant one. We would all of us like to attend *all* of the conventions, but unfortunately most of us have to spend more or less time making our living, and unlike Artemas Ward, who declared that "when he did drink he never let business interfere with it," we have to keep our noses to the grindstone on many an occasion when we would like to be applauding the sentiments of our fellow-workers in conventions assembled.

The convention is unquestionably a good thing, the only question being which of all those scheduled can be omitted with least baneful result upon our knowledge and enthusiasm. If we took them all in, literally and socially, we would surely become as gods, and would know good from evil to such a degree of detail that there would be no living with us. If a *little* knowledge is a dangerous thing, as Pope declares, then what must be the danger of a vast amount of knowledge? It is perhaps fortunate after all that a wise Providence compels us to earn our bread by the sweat of our brows, rather than by the exercise of our literary and elocutionary powers.

Since we must choose, then, let us give careful consideration to the claims of the Illuminating Engineering Society Convention. To those who have attended the previous conventions no urging need be brought forth; they have always been well worth the effort and time expended, and from reports thus far obtainable, which we regret do not include a list of the papers to be presented, the Chicago convention promises to keep up with the pace already set. It is impossible to conceive that Chicago would allow herself to be beaten in the matter of conventions, whether illuminating or otherwise, and so the safe advice is perhaps, to paraphrase Hoyle, "When in doubt take in the Illuminating Engineering Society Convention."

Notes and Comments

LIGHT AS A PREVENTATIVE OF CRIME

While it has long been recognized that well lighted streets are comparatively safe, the full extent of the measure of protection afforded by this means has perhaps never been realized. A Chicago Alderman is conducting an active campaign to "clean up" Chicago by a lavish use of street lamps made possible through the electric energy generated by the famous drainage canal. We have reported Mayor Harrison's statement that Chicago is *to be* one of the best lighted cities in the world. Alderman Geiger makes the contrasting statement that at the present writing it is probably the worst lighted large city in this country, according to a report in the *American:*

Although in the front rank of the great cities of the world in many respects, Chicago has the poorest lighted streets and alleys of any city of consequence in the United States. In the very busiest sections and in some of the best residence districts the streets are so dimly lighted that it is hardly possible to recognize your best friend in passing.

He believes that this condition should

be removed, and that by installing a sufficient number of electric lamps Chicago could not only be made the best lighted, but the safest city in the world:

Not on theory, but on proved ground, is Alderman Geiger standing in his claim that in comparatively inexpensive illumination lies the cure for outlawry that costs lives of many citizens and policemen annually. He has before him the precedent set by the famous Inspector Byrnes in New York.

Years ago, when electric lights were first coming into use, Byrnes conceived the plan of so lighting the haunts of gun men that they would abandon their pastime of killing each other through fear of identification and capture.

When Byrnes first suggested his scheme he was laughed at. The idea of these desperadoes, who had made human life cheaper around Mulberry Bend and the Five Points than anywhere else in the world, being afraid of a little thing like a street lamp was called absurd.

But Byrnes knew criminals and their ways. He got his lights and he told the electricians where to put them. To-day the Mulberry street and the Five Points gangs are no more.

What Byrnes did in two centers of crime Chicago can and ought to do. With unlimited electric power owned by the taxpayers in their Sanitary District, the city easily can be made the brighest lighted and safest city in the world. A few thousand more arc lamps would accomplish what an army of police could not.

GAS ARCS TO BE USED FOR SPECIAL STREET ILLUMINATION

In view of the fact that the gas arc has cut no figure in the numerous permanent "White Way" installations, it is rather startling to hear that Ashtabula, Ohio, is installing them temporarily to furnish special illumination during its coming Centennial celebration. The gas interests aver that it is much cheaper to pipe a house for gas than to wire it for electricity, and it may be that the laying of gas mains on top of the pavement along the curb may be equally inexpensive. At any rate that is the method being used in this case. The following is from the *Beacon:*

Preparations are already well along for the illumination of Main, Bridge and Depot streets during centennial work with gas lights.

There will be thirty-six big lamps on Main street, twenty on Bridge street and ten on Depot street, a total of sixty-six.

It is proposed to place the pipe along the curbing and to hang the lamps from poles about seventy-five feet apart and alternated between the two sides of the street between the Nickel Plate railway tracks and Division street.

Poles of either the city or of the telephone company will be used as may be found most convenient.

Each of the lights is what is known by the gas companies as 2,400 candle power lamps.

BLUNDERS OF POPULAR SCIENTIFIC WRITERS

The newspaper reporter may be excused for inaccuracies in dealing with technical subjects; his business is to gather news, and he is not assumed to be a scientist. But with a man possessing a college degree, and assuming to write for a leading scientific journal, the case is very different. Articles in such cases carry great weight with the lay reader, and blunders may produce much mischief. A recent article in the *Revue Scientifique,* by Dr. Jean Ecard, purporting to be a popular treatise on the various light-sources and their effects upon the eyes, is a masterpiece of inaccuracy and fallacious scientific writing, in evidence of which the following quotations may be taken:

The petroleum lamp is the least harmful in this respect. Then follow gas, the incandescent electric lamp, the Welsbach incandescent mantle and acetylene. The chief disadvantages of these sources of light is that they tend to produce congestion of the eye. This may be remedied by the use of glasses, which are specially thick or tinted gray, yellow or red. These colors do not sensibly diminish the illuminative power of the sources of light, but absorb all the harmful rays.

The action exerted on the respiration is specially marked in the case of the gaseous products of combustion, which rapidly penetrate into the organism and carry with them any toxic compounds they may include.

Most of the permanent gases form explosive mixtures with air. Acetylene must be regarded from the point of view of explosibility in contact with air, and a flame as much more dangerous than ordinary coal gas. Its limits of explosibility are, in fact, much more extended than those of the latter substance.

PROGRESS OF LIGHTING AS SEEN BY THE DAILY PRESS

NEW HAVEN, CT.—Project is on foot for the better lighting of Chapel street. A conference was held between the business men doing business on that street and Frederick D. Adams, secretary and treasurer of the United Illuminating Company,

out of which came a proposition that seems to meet much favor. It is proposed to erect iron standards of graceful and pleasing design along both sides of the street, from which will hang six or eight lights of the tungsten variety in each block. The merchants will be expected to pay the cost of the lighting out of their own private funds. Many of the merchants have already committed themselves to the system.

CHEYENNE, WYO.—Cheyenne will be the city brilliant during the Frontier celebration. In years past the city has always been profusely decorated on this occasion, but the Frontier committee and the city officials are determined that this year's decorations shall eclipse anything heretofore undertaken.

NEWARK, N. J.—Consideration was given by members of the joint bridge committee of the Essex and Hudson County Boards of Freeholders recently to the lighting of the Plank road.

In a letter to the committee the Public Service Electric Company suggested that either arc lamps be installed 250 feet apart on alternate sides of the street, or that high powered incandescent lamps be placed on the trolley poles to be put in the centre of the roadway.

Freeholder Frank L. Driver suggested that it might be well to have the road illuminated with flaming arc lamps. The committee discussed the matter at length and decided not to come to any final decision until after an inspection had been made of several boulevards in nearby places.

ELIZABETH, N. J.—It is probable that some action will be taken toward closing a contract for increased illumination in Broad street, between the railroad arch and West Jersey street, at a meeting of the Broad Street Improvement Association to be held shortly in the Board of Trade rooms. Most of the Broad street business men have joined in the scheme and the amount of money subscribed is now large enough to warrant the closing of a contract for better lighting.

BALTIMORE, MD.—Robert J. McCuen, Superintendent of Lamps and Lighting, today completed tentative plans for the lighting of the new boulevard and University parkway. The announcement that the plans for the lighting of this boulevard, which is to be Baltimore's finest thoroughfare, means more than the mere mapping out of the plans for lighting, because the installation of the lights will mark a new era in the city's progress, in that gas mains, conduits, etc., will be laid under the sidewalks, and will not necessitate the tearing up of the street, as is now done over the entire city when lamps are to be connected up or gas mains attended to.

BURLINGTON, IA.— Now that the boulevard lights have been installed on the east side of Main street, interest in the plan is again growing. There was a time when everybody seemed to be in favor of the project. And then some difficulties arose and the work was dropped temporarily, because other apparently more important matters required immediate attention.

It is stated that in a very few days the committees will be able to announce that other sections have been signed up and that the installation can begin at once. The cost of the very handsome improvement is a very small matter and the system a very good advertisement for the city and for the individual business man. No doubt, by the time cool weather sets in, the business section will be covered by the new system and Burlington's evening illumination or special illumination will compare favorably with that of other western cities.

DENVER, COLO.—The board of public works will experiment in a new style of ornamental street lighting. The standards will be upright in conformity with those in use at present, but are to be constructed of a cement and marble mixture, surmounted by a decorative bronze cap. Fifty of the standards will be placed along Seventeenth avenue boulevard from Colorado boulevard to Dahlia street.

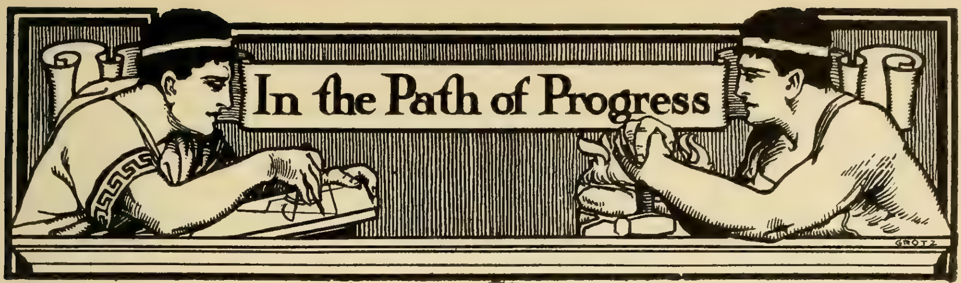
The contract for the construction of the standards will be let next week. The lights are to be tungstens.

The style of the design is regarded by many as superior to the type of light standards in use along Sixteenth street.

WATERLOO, IA.—A petition was started two or three days ago on the west side among the merchants for the purpose of finding out how many of them were willing to install the new boulevard lights. Out of fourteen business men only one was found who refused to sign the petition. However, this will not stop the progress of installation as the other merchants will contribute enough out of their own pockets to pay for the lights in front of the property of the one who refuses to do so himself.

The proposition is this—if the business men will pay for the standards for the new lights the city will furnish the lights. All the business men from Jefferson street to Bluff street on Fourth street gladly signed up with but one exception.

GALVESTON, TEX.—Chairman J. G. Smith, of the committee on illumination, is distinctly pleased with the progress made along the lines of lighting up the business section of the city. "It is very gratifying," said he, "to see the manner in which the retail merchants and other firms about the business district have responded to the request for contributions to cover the expense of illuminating downtown Galveston. Continuous string of electric lights will be used. The material is already at hand, and Contractor William Rowley has already commenced this work. There are still some who have not joined in this movement, but they will have the next few days in which to get in touch with the committee."



Edwin M. Herr Becomes President of the Westinghouse Electric & Manufacturing Company

MR. EDWIN M. HERR.

The name of Westinghouse is intimately connected with the history of electric lighting in this country. The Westinghouse Electric & Manufacturing Company, East Pittsburgh, which is the result of his inventive and executive genius, is both directly and indirectly one of the big factors in the electric lighting industry in this country. The personnel of its management will therefore interest all who are concerned in the subject of lighting. The following facts are furnished through the courtesy of its Publicity Department:

At a meeting of the Board of Directors of the Westinghouse Electric & Manufacturing Company, held in New York on August 1, the following officers were elected: Chairman of the Board of Directors, Robert Mather; president, Edwin M. Herr; vice-presidents, Loyall A. Osborne, Chas. A. Terry, Harry P. Davis; acting vice-presidents, Henry D. Shute, George P. Hobard; comptroller and secretary, James C. Bennett; treasurer, T. W. Siemon; auditor, F. E. Craig.

Mr. E. M. Herr is elected to succeed Mr. Edwin F. Atkins, who has been president of the Company since June, 1910, and who declined re-election. He has announced the appointment of Calvert Townley as assistant to the president.

Mr. Herr was elected at a meeting of the Board of Directors held in New York August 1. He had been the first vice-president of this Company and in charge of operation of same at East Pittsburg since June 1, 1905.

He was born in Lancaster, Pa., May 3, 1860. Upon completion of a common school course, he was given the position of telegraph operator on the Kansas Pacific Railroad, with which company he remained for two years. He was promoted from the construction train service to the position of station agent.

In 1881 he entered the Sheffield Scientific School of Yale, graduating in the class of 1884, and worked as an apprentice in the shops of the Pennsylvania Railroad Company at Altoona, Pa., during the two summer vacations.

From 1884 to 1885 he was an apprentice at the West Milwaukee shops of the Chicago, Milwaukee & St. Paul Railroad. He then went to the Chicago, Burlington & Quincy Railroad Company as a draughtsman in the Mechanical Engineer's office, and afterwards became Assistant Engineer of Tests, and was promoted from this position to Engineer of Tests on this road at Aurora, Ill.

From 1887 to 1889 he was Superintendent of Telegraphy, and from 1889 to 1890 was Division Superintendent of this road.

From 1890 to 1892 he was Division Master Mechanic of the Chicago, Milwaukee & St. Paul Railroad at West Milwaukee.

From 1892 to 1894 he was Superintendent of the Grant Locomotive Works at Chicago.

From 1895 to 1897 he was Superintendent of Motive Power and Machinery of the Chicago & Northwestern Railroad. From June 1, 1897, to September 10, 1898, he held the same position with the Northern Pacific Railroad.

On September 10, 1898, he became Assistant General Manager of the Westinghouse Air Brake Company at Wilmerding, Pa. He was promoted to the position of General Manager on November 1, 1899, which position he held until June 1, 1905, when he was elected First Vice-President of the Westinghouse Electric & Manufacturing Company.

Mr. Calvert Townley, who was for many years connected with the Westinghouse Electric & Manufacturing Company, at first in Pittsburg and later as Manager of its Boston Office, and as Special Representative in New York City, comes to the Company directly from the New York, New Haven & Hartford Railroad Company, where for the past five years he has been closely identified with the electrification of this road.

Mr. Harry P. Davis has been with the Westinghouse Company for twenty years, and for the last few years has held the position of Assistant to First Vice-President and Manager of Engineering at the East Pittsburg Works.

Heany Lamp Case

About four years ago Mr. John Allan Heany, of York, Pa., and his patent attorney and a young assistant examiner in the Patent Office were indicted on charges of fraud and conspiracy in altering certain patent applications of Heany, then pending in the Patent Office, in an attempt to introduce into them inventions relating to tungsten incandescent lamps which had been made by others, information with respect to which, it was alleged, had been fraudulently obtained through the assistant examiner. On the trial the assistant examiner pleaded guilty and the attorney was tried and convicted, both being sentenced to imprisonment, and Heany was acquitted.

On the termination of the criminal proceedings the Commissioner of Patents caused an investigation to be made with the object of ascertaining whether the fraudulent alterations in the applications were made with the knowledge or connivance of Heany. It was interrupted by a proceeding filed by Heany and the Heany Lamp Company, in the courts of the District of Columbia, in an attempt to enjoin the investigation. An injunction was issued by the lower court, but was set aside by the Court of Appeals and investigation was then resumed. Testimony was taken and a full opportunity afforded to Heany and his associates to put in a defence. The decision of the Commissioner of Patents, by Mr. Assistant Commissioner Billings, has now been handed down, holding that the applications of Heany pending in the Patent Office involved in the investigation had been tampered with, and that among other things two sheets of paper on which the specification of one of the important cases was written had been abstracted and two other sheets substituted in place thereof; that this was done in pursuance of a conspiracy to fraudulently secure patents which would control the tungsten lamp business, and that Heany was a guilty party to the conspiracy. The Commissioner has ordered that certain pending interferences in which these applications under investigation were involved be dissolved as to the party Heany; that the Heany applications referred to be finally rejected on the ground of fraud, and that an indorsement to this effect be made on the applications and that they be removed from the files of the active cases of the Office.

Mr. D. McFarlan Moore Receives the John Scott Medal of the Franklin Institute

The John Scott Medal, which is awarded by the city of Philadelphia to meritorious inventors on the recommendation of the Franklin Institute, has, upon the recommendation of the Committee on Science and the Arts, been awarded to Mr. D. McFarlan Moore for his work in developing vacuum tube lighting. The concluding paragraphs of the committee's report are as follows:

"The system has been fully described by the inventor in the recent issues of technical periodicals and experimentally demonstrated before the sub-committee, and the evident practical uses to which the system has been applied and the reliable operation of the component parts of the apparatus have proven that the

claims of the inventor are well founded.

"Mr. Moore has undoubtedly by his skill and energy made this particular field of research practically his own, and in consideration of the successful results obtained and the ingenuity of the means employed the Institute recommends that the Philadelphia Board of City Trusts shall award the John Scott Legacy Premium and Medal to D. McFarlan Moore, of Newark, New Jersey."

Interchangeable Showers and Ceiling Fixtures

It is well known to those in the trade that fixture manufacturers make a large number of their designs by varying the combinations of standard parts, such as canopies, arms, bodies, husks, stems, etc.

The F. W. Wakefield Brass Company of Vermilion, Ohio, have carried this process a step farther, and made it possible for the local dealer to carry a line of parts, and assemble fixtures to meet his own tastes or conditions. The latest effort in this direction is in the way of the "shower" type of fixture, which has achieved such great popularity within the last few years. By various arrangements of ceiling plates, stems, chains, canopies, and husks, a variety of excellent designs can be formed, one of which is shown in the illustration. This obviates the necessity of carrying a large stock of completed fixtures, thus economizing both room and investment, while enabling the dealer to supply the demands of his customers immediately.

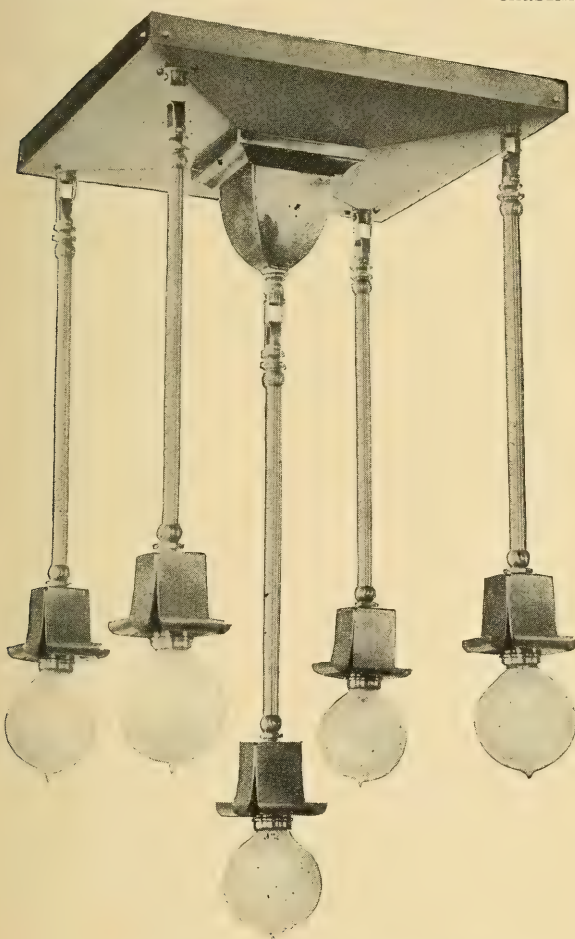


FIG. I.—ONE OF THE NEW LINE OF WAKEFIELD FIXTURES.

H. M. Hirschberg to Handle "Plania" Carbons

Mr. H. M. Hirschberg, well known as president of the Excello Arc Lamp Company, New York, has concluded arrangements for the exclusive importation of "Plania" carbons into this country. The Plania works in Ratibor, Silesia, is perhaps the largest carbon factory in the world, employing over eighteen hundred hands.

Besides all forms of electric arc lamp carbons, they are the only manufacturers of large carbon electrodes for electric furnaces. Mr. Hirschberg will carry a full stock of all sizes and types of arc carbons.

Salt Lake City to Have An Electric Show

The Electric Show Association of Utah, of which Mr. B. W. Mendenhall is president, has issued a prospectus of the first annual electric show to be held October 2 to 7. This is the week of the Mormon Conference and the Annual State Fair, which will bring to the city more than 25,000 visitors.

Extensive and elaborate plans for special electric street illumination are already under way, and prizes are to be offered for the most original and best exterior lighting displays by business houses. The show will undoubtedly receive ample patronage from citizens and visitors, and any one who has any reasonable pretext for getting within a day's ride of Salt Lake at this time should make it a point to attend.

Gas Salesmanship Course

Lesson No. 2 in the course of the salesmanship being offered by the National Commercial Gas Association has recently been issued to the subscribers of the course, which now number over five hundred. The title of the lecture is "Practical and Personal Elements in Selling Gas." Under the topic, "Analysis the Basis of Efficient Selling," the questions of analyzing both the business proposition and the salesman's own personal characteristics are discussed somewhat at length, and from the results of the analysis of conditions, general precepts are deduced as to the best methods of procedure. The treatment of the whole subject is clear and logical, and contains sound advice for the would-be salesman. The writer is possibly overly fond of a good story, making very free use of this method of illustrating his points. His treatment of the subject, however, is unusually free from either platitudes or hair-splitting psychological discussion, and his directions are sane and practical.

The Annual Meeting of the Michigan Gas Association

The twentieth annual meeting of this association will be held at the Hotel Pontchartrain, Detroit, September 20 to 22. The program of the papers follows:

1—Scrubbing Gas with Tar. Professor Alfred H. White and Holder of the Scholarship.
2—Advertising—A Brief. Prepared by C. A. Brownell.
3—Experiments in the Taylor System of Shop Practice. Ben M. Ferguson.
4—A Purchasing System for a Gas Company. Albert G. Schroeder.
5—a—Use of Reinforced Concrete in a Gas Works. H. W. Douglas.
b—A Concrete and Wood Condensor House. E. F. Lloyd.
6—Filament Ignition of Gas. Professor Howard Lyon.
7—Development of the Hotel and Restaurant Gas Appliance Business. W. F. Clausen.
8—Directions for the Recovery, Concentration and Testing of Ammonia. Presented by James A. Brown.

An attractive entertainment program has also been provided, including theater parties and automobile rides. The many attractions of Detroit and its environs, added to the fact that it has one of the livest gas companies in the country, should be a further incentive for a full attendance at this convention.

Baseball "de Luxe"

Rival baseball teams of three lighting companies played a double header at Oriole Park, Baltimore, on July 29. The White Sox of the Consolidated Gas Electric Light & Power Company tackled first the crack nine of the Edison Electric Illuminating Company of Brooklyn. The struggle lasted for twelve innings, and at its close the White Sox sallied forth again to do battle with the fast squad of the United Gas Improvement Company of Philadelphia.

Brooklyn took the first game by a score of 3 to 2, and Baltimore won the second by a score of 3 to 1.

New Publications

ENGINEERING AND SALES DATA ON HOLOPHANE UNITS FOR STREET LIGHTING.

This publication is Bulletin No. 101 of the Holophane Company, Newark, Ohio, and was issued July 15. It gives very complete data regarding the use of the new Holophane street lighting unit, describing various arrangements of the units for practical use with illumination results. A large amount of the matter is of general value, applying to all kinds of luminants.

PHOTOMETRIC CURVES OF ALBA SHADES.

This is a very elaborately prepared booklet, issued by the Macbeth-Evans Glass Company, Pittsburgh. Photometric curves of their various sizes and types of shades are given on a large scale, making it easy to read the values from any point. A table for determination of foot-candles of illumination from the curves of distribution is also given.

Proceedings of Technical Societies

The Acetylene Convention, 1911

Reported by A. Cressy Morrison

The thirteenth annual meeting of the International Acetylene Association was held at Atlantic City, N. J., Hotel Chalfonte, July 25, 26 and 27. Certainly the number "13" has no significance for acetylenists, for it was beyond question the most successful meeting the association ever held and indicated the remarkable prosperity of acetylene industry.

Mr. Benjamin O'Shea of the Union Carbide Sales Company of Chicago presided. Mayor Stoy of Atlantic City had accepted an invitation to attend the opening convention and extend the welcome of Atlantic City to the visiting acetylenists, but his death a few days prior to the convention prevented this and caused many expressions of regret and sympathy from those who remembered his courtesy during their previous visit to Atlantic City. In his stead, however, Mr. Charles E. Wagner, president of the Hotelmen's Association of Atlantic City, welcomed the acetylenists and extended the freedom of their "beautiful city by the sea." Mr. Moritz Kirchberger of New York responded.

The president's address was replete with sound recommendations. He referred to the keynote of the acetylene industry, which is all that can be included in the one word, "quality." From a practical standpoint this means that better construction, better installations, better materials, better methods and, it might be added, better men, are the objects of the association and hence the objects of the industry. The advances in all these particulars which the industry is making is finding its practical expression in the vast increase in the use of acetylene. The presidential address was received with thoughtful consideration and enthusiastic approval.

The report of the secretary, Mr. A. Cressy Morrison of Chicago noted the progress which the acetylene industry is making in the estimation of official bodies. The association by its correct methods, by its ideals and its strong stand for the right has won the confidence of the insurance authorities, the United States Government, the city officials and transportation companies, all of whom are giving serious consideration to the acetylene industry and regard any utterance of the association as authoritative. A great deal of progress has been made in the modification of rules and regulations in the direction of more liberal treatment and also in the direction of safer practice. The secretary reported an increase of over thirty members during the past year and the rapid approach of the total membership to the 200 mark.

The report of the treasurer showed a handsome balance in the treasury and that the financial condition of the association was sound.

The by-laws of the association were very carefully revised and many new provisions adopted. The revision was made necessary by the growing responsibility of the association and the necessity for a more orderly arrangement.

The report of the Legislative Committee, Mr. Oscar F. Ostby of New York City, chairman, showed that the fight which has been going on all over the country, intending under the language of proposed laws to limit the methods of headlight illumination for railroads to electricity, had met with con-

sistent defeat. Considerable evidence was presented in the report which tended to show that the great utility of acetylene for headlight purposes on locomotives and its superiority in many conditions, had been successfully demonstrated throughout the country. The Legislative Committee had insisted that any law which by means of its peculiar wording would prevent any other means of illumination than electricity for locomotive headlights, would stop progress and stifle inventive genius in other directions. Much other legislative work of grave importance was accomplished by this committee, and its success was a clear demonstration of the wider appreciation of the great utility of acetylene as an illuminant.

The report of the Committee on Insurance, Mr. A. Cressy Morrison, chairman, showed that remarkable progress had been made during the past year.

The mutual insurance companies, which have in some instances been hostile to the adoption of the National Board rule permitting inside installations, have during the past year receded from this position and now the greater safety of acetylene as an illuminant is clearly recognized by these bodies.

Attention was called to the fact that under the insurance laws of the State of Minnesota the old insurance regulations governing the storage of calcium carbide had been adopted by the State Government, and that the State of Minnesota after a careful investigation of the subject had adopted the National Board ruling permitting the storage of not exceeding 600 lbs. of calcium carbide in insured premises without any increase in the rate and with the clear understanding that this quantity is not considered an additional hazard.

A special amount of effort has been put forth in the New England States with a view to securing a revision of the rules of the New England Insurance Exchange toward the adoption of the National Board ruling governing the installation of acetylene generators, and already the Executive Committee of the New England Insurance Exchange has reported to the Exchange favorably recommending the adoption of these rules. This means great progress for acetylene in the New England States.

Among the salient points brought out in the report which have never been put into concrete form were the following:

The insurance industry in submitting its mechanisms to the National Board of Fire Underwriters in order that they may be examined and permits issued for their use, fortunately agrees to abide by the rules and regulations of the National Board. The requirements of the National Board governing the character of the material, the mechanisms and devices calculated to increase the safety of the use of acetylene, add to the cost of the construction of an acetylene generator anywhere from $12 to $28, according to the size. In other words, an acetylene generator might be constructed which would operate perfectly, but which would not possess the strength and safeguards required by the National Board, for the sums above mentioned less than by complying with the National Board requirements and might presumably be sold with a wider margin of profit. As it is known that over 30,000 permitted acetylene generators were sold in the United States last year, the tax which the acetylene industry voluntarily and gladly pays that it may comply with the National Board rules, lies somewhere between $400,000 and $600,000 per annum. This is greater than the total fire loss from acetylene since its introduction.

Official records from two States, Ohio and Nebraska, showed that with 18,000 acetylene generators installed in Ohio, of which 14,000 were installed inside of homes, only one fire loss has occurred in the past two years; and with approximately 10,000 generators installed in the State of Nebraska, of which 8000 are inside, there were no fire losses during the years 1909 and 1910. These two instances of the exceptional safety of acetylene as an illuminant become remarkable when in Ohio alone the use of acetylene in 18,000 country homes is equivalent to a city of 100,000 people going for two years without a fire caused by its illuminants. Such a record is astonishing.

The pleasing fact was also brought out that these two records were not excep-

tional, and were official reports equally complete from other sections of the country, undoubtedly the average condition would be extremely high. These facts have been brought home to the insurance officials and other Government bodies with great force by the association and the general recognition of the safety of the permitted acetylene generator is the result.

The report of the Oxy-Acetylene Committee, Mr. Augustine Davis of New York, chairman, pointed out the very astonishing progress of this phase of the acetylene industry in this country. As is well known, in Germany, France and England this process has been in successful use until there seems to be no line of metal working in which the oxy-acetylene flame with its extraordinary temperature of 6300 degrees F. has not found a place.

Attention was called to the fact that in many metal-working establishments automatic machines are now being used which are so accurate that oxy-acetylene welding and cutting is being accomplished mechanically.

The prophecies as to the rapidity of the introduction of this process into the United States made last year and the year before have more than been fulfilled, and among the very gratifying facts of the past year has been the adoption of the oxy-acetylene principle in practically all the metal-working establishments of the United States Government during the past year.

When it is remembered that with the oxy-acetylene flame a vast structure like a bridge may be cut in two in a few hours, and, if necessary, in a few hours more welded together again, the wonderful possibilities of this new phase of the acetylene industry promise to revolutionize many phases of metal working.

Attention was called in the discussion following Mr. Davis's paper to the fact that the German Government has taken up the oxy-acetylene process officially and has required all the professors in the mechanical schools of Germany to take a course in oxy-acetylene welding and cutting and introduce this course in the curriculum of the institutions which they represent. Mr. J. M. Morehead, who led this discussion, had just returned from an extended tour of Europe and confessed himself astonished at the remarkable things that were being done with the oxy-acetylene flame in foreign countries.

The report of the Committee on Promotion was read by Mr. Elias A. Long, editor of the *Acetylene Journal,* the official organ of the International Acetylene Association. A collection of the literature of acetylene during the past year, as put forth in the catalogues and pamphlets of the various manufacturers, was reviewed, and remarkable progress in the character of the presentation, in the conservatism of the statements made and the better understanding of the acetylene industry was disclosed.

Favorable comment was extended to the annual reports of the International Acetylene Association, which were said to be as dignified reports as issued by any other commercial body. Mr. Long, with characteristic modesty, emitted only a casual reference to the official organ, the *Acetylene Journal,* but the great work of this publication for all that is good in the acetylene industry needs little announcement, as wherever the *Acetylene Journal* goes, its character and great usefulness is well understood.

The report of the House and Town Lighting Committee, Mr. M. J. Carney of Chicago, chairman, disclosed the fact that more acetylene generators had been sold during the past year by a very large percentage than had ever been sold in any similar period, and pointed out that the growing appreciation of acetylene and the better understanding of its usefulness was aiding by making the sale of the acetylene generator much less of an effort than even during recent years. The report contained a recommendation which was subsequently adopted, that a Board of Engineers be appointed, whose tenure of office should be for five years, who shall have the power to compile and submit standard rules and regulations which shall tend to further safeguard the industry and which shall be adopted by the association with such additions and modifications as may be necessary. It shall be the duty of the Board of Engineers to

continually study conditions, learn the cause of accidents and make recommendations that will prevent their recurrence from similar causes.

The report of the Appliance Committee, read by Mr. H. I. Gannett of Buffale, N. Y., called the attention of the members of the association to the amazing ramifications of the acetylene industry and its remarkably extending use. Attention was called to the fact that the sunlight quality of acetylene was being used in a leather industry by a process which from the beginning of the industry has required sunlight, and which is now being completed under acetylene illumination with the advantages of a continuous operation even when the sun is obscure during the day and by the use of the continuous process during the night, shortening the time of operation to a very large extent.

The report of the Portable Apparatus and Marine Lighting Committee, read by Mr. A. J. Jenkins of Baltimore, covered this very wide field ably, and, among other points of importance, brought out the fact that the acetylene buoy and beacon were rapidly superseding almost all other means of illumination and had the most cordial good-will of the various Light-House Boards and especially of mariners and seafaring men.

Among other extraordinary facts it was demonstrated that 85 per cent. of all the automobiles in use in the United States were equipped with acetylene in some form, which means that certainly 400,000 separate installations may be found upon modern vehicles.

The report of the special Committee on Standard Threads, read by Mr. Paul J. Kruesi, was very complete and showed that in the gas and electric industry there have been a wide variety of threads used and that while many manufacturers declared it impossible, there had been during the past year very considerable progress made in bringing about a uniform standard so that, gas fixtures and burners when so standardized, the joints would be tight and much useless trouble removed.

A paper by Mr. J. K. Rush of Syracuse, N. Y., showed the progress of electric ignition and opportunities for bettering the acetylene industry. Devices have now been prepared, which by simply pushing a button or by turning on the gas will bring about ignition with the same convenience that accompanies the use of the electric light.

An address by Prof. G. G. Pond of State College, Pennsylvania, called attention to the advances which he had observed in all phases of the industry since he first became interested in the subject by a request from the Pennsylvania State Government for him to prepare a bulletin in the year 1900. He called particular attention to the fact that the attitude of acetylenists had been one of growing appreciation of the necessity of improving acetylene devices and properly safeguarding them. The business had become gradually one requiring considerable scientific knowledge and high order of engineering ability, and this was telling in the greater safety of the appliances and the consequently firmer foundation on which the industry rested.

The election of officers took place at the last session and resulted in the selection of Mr. A. C. Collins of the Davis Acetylene Company, Elkhart, Ind., for president; Mr. Moritz Kirchberger of M. Kirchberger & Co., New York City, for vice-president, and Mr. A. Cressy Morrison of the Union Carbide Sales Company of Chicago, secretary-treasurer. The following directors were elected: Mr. W. P. Shockey of the Union Carbide Sales Company, Chicago; Mr. H. G. Offutt of the Model Generator Company, Louisville, Ky., and Mr. J. K. Rush of the J. K. Rush Company, Syracuse, N. Y.

The annual banquet took place at the Hotel Chelsea and formed the usual agreeable termination of the meeting of the association.

International Photometric Commission

The International Photometric Commission was founded at the Congress of Gas Engineers in Paris during the Exposition of 1900. It has since held two sessions in Zurich, in the years 1903 and 1907. The third session was held in the same city July 26 to 29. The sessions were

private, a general report being furnished to the press later by the commission. The programme of the proceedings was as follows:

1. Reception and discussion of a report on the methods of photometry in use in Germany, by Dr. Eitner.

2. Discussion of the conclusions deducible in regard to the absolute illuminating power obtainable by incandescence and the absolute illuminating power of flames from the results of experiments reported on by M. Sainte-Claire Deville in 1903 and 1907, and the experiments made subsequently in Carlsruhe.

3. Private business.

4. A communication by Messrs. Butterfield, Haldane and Trotter on corrections for the effect of atmospheric conditions on photometric flame standards.

5. Rectification of the numbers settled at the 1907 session for the ratios subsiding between the intensity of the lights of the Hefner, Carcel, and Vernon Harcourt lamps.

6. Substitution of calorific power for the illuminating power of gas.

7. Photometric dimensions and units.

8. The international standard of light.

A general review of the proceedings will be given in a later issue, when the papers are all at hand.

The paper on "Corrections for the Effects of Atmospheric Conditions on Photometric and Flame Standards" gives the reports of experiments conducted by the authors under peculiarly favorable circumstances, they having had placed at their service a large steel tank formerly used for physiological research on caisson diseases. This enabled the experiments to be carried out under any given atmospheric conditions. The effect of variations in atmospheric humidity and contents of products of combustion were also worked out.

As a result of their investigations the following formulas for corrections are given:

The corrections found for the Harcourt and Hefner lamps may be applied thus:

Let A = the accepted normal percentage of aqueous vapor in the air.

Let C = the accepted normal percentage of carbon dioxide in the air.

Let P = the accepted normal pressure of the air in millimeters.

Let a = the prevailing percentage of aqueous vapor in the air when the lamp is in use.

Let c = the prevailing percentage of carbon dioxide in the air when the lamp is in use.

Let p = the prevailing pressure of the air when the lamp is in use,

then the actual light (I′) of the lamp at the time, expressed in terms of its light (I) in normal conditions will be found with sufficient accuracy for all practical purposes from the equations:

For the Harcourt lamp:

$$I' = \frac{100 - \left(\frac{a - A}{0.16} + \frac{c - C}{0.035} - \frac{p - P}{12.5}\right)}{100} I$$

For the Hefner Lamp:

$$I' = \frac{100 - \left(\frac{a - A}{0.16} + \frac{c - C}{0.045} - \frac{p - P}{25.0}\right)}{100} I$$

New Jersey State Gas Association

The organization of this association was completed at a meeting held on August 16 at the Coleman House, Asbury Park, N. J.

The business session was preceded by a luncheon, which was well attended. Following this the meeting was called to order in the auditorium of the hotel by the president, Mr. Wm. H. Pettes at 3 o'clock.

The president read the call for the meeting and explained briefly the purpose of the gathering. Following this, he introduced Mr. Elcock of the United Gas Improvement Company, who presented a most interesting paper on the subject of "New Business." The paramount point which Mr. Elcock sought to bring out was the fact that no salesman can be a thoroughly competent salesman unless he has had at least a brief training in the elementary principles of the business.

Following Mr. Elcock's paper, Dr. Galloway of the New York University, who is conducting the course of salesmanship given by the National Commercial Gas Association, delivered an address on this same subject. He quoted some of the answers which he had received to questions asked in this course, which in many

cases proved to be humorous, in all cases interesting.

Mr. Butcher, vice-president of the Freehold Gas Light Company, gave a very interesting sketch of the foundation and organization of the company he represented at the meeting, this laying claim to the distinction of being the oldest gas company in the State of New Jersey, having been organized in the early fifties.

Mr. Hanlon, manager of the New Business Department of the Public Service Corporation of Newark, spoke on the subject of salesmanship, and told many of his own experiences, which were extremely interesting. As Mr. Elcock had done, he also emphasized the importance of a salesman being well educated in the elementary principals of the industry before being sent out to actually solicit business or sell appliances.

Annual Convention of the National Commercial Fas Association

The seventh annual convention of the National Commercial Gas Association will be held at Denver, Colo., October 23 to 28. The programme of papers arranged for up to the present time is as follows:

"An Equitable Sliding Scale for the Sale of Gas."
(Editor not yet selected.)
"Up-to-date Advertising Methods."
Thomas R. Elcock, Jr., Adv. Mgr.,
The U. G. I. Co., Philadelphia, Pa.
"Illuminating Engineering and its Application to the Gas Industry."
E. Leavenworth Elliott, Editor,
The Illuminating Engineer, New York.
"Exhibit and Description of Model Glass Gas Works."
A. F. Traver, Supt. Gas. Dept.,
Denver Gas & Electric Light Co.,
Denver, Colo.
"The Modern Gas Fixture."
Charles Ummach, Secretary,
R. Williamson & Co., Chicago, Ill.
"The Designing and Construction of Gas Appliances."
Robert K. Clarke,
George M. Clarke Stove Co.,
Chicago, Ill.
"Increased Efficiency in Scientific Office Accounting."
Paul R. Jones, Auditor,
Doherty Operating Co.,
60 Wall St., New York.
"Practical Demonstration Work."
Mrs. Anna A. Carroll, Demonstrator,
The U. G. I. Co., Philadelphia, Pa.

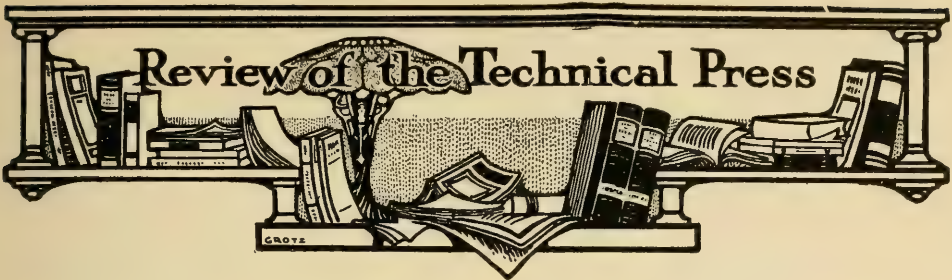
The entertainment features to be provided are particularly attractive, especially to the tender-foot of the East. The location of Denver, in one of the most interesting sections of the Rockies, offers facilities for varied and interesting entertainment which few cities possess. Besides the usual theatre parties, auto rides through the city and suburbs, smokers for men, luncheons and receptions for the ladies, a three-day trip through the mountains, to follow the close of the business session, has been arranged. A feature of this outing will be a cowboy chuck wagon dinner in the Garden of the Gods followed by a genuine exhibition of roughriding.

The meeting as a whole, therefore, offers not only the prospect of "A feast of reason and flow of soul," but opportunities for genuine recreation that can rarely be combined with important business interests.

The association is counting on a record attendance, and will probably not be disappointed. The increase in membership during the year has been large. The Membership Committee has offered two prize trips to the Denver convention to the members securing the highest percentage of increased membership based on the relation which the number of applications bears to the population of the city from which received, thus offering an equal opportunity to men in a small community with those in large cities. The prizes will be worth, appoximately, $125 each—surely well worth trying for. Interest in the work has increased proportionately.

The chorus of "On to Denver," which was so heartily sung at the Boston convention, has been re-echoing through the gas interests ever since. The motto that used to decorate the "prairie schooner" of the gold-seeker, "Pike's Peak or Bust," has again become an active slogan.

Full information as to train service, etc., can be obtained by addressing Mr. Louis Stotz, secretary of the association, 29 West Thirty-ninth Street, New York City.



American Items

New Books

Das Elektrische Bogenlicht. Physikalisch - Technische Grundlagen der Lichterzeugung Durch Elektrische Entladungsvorgänge von Ewald Rasch, Oberingenieur. Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn, 1910.

The object of the author of the book, " Das Electrische Bogenlicht," is to impart to the illuminating engineer the strictly scientific foundation of the art of illumination, especially arc light illumination. The book enables the student to grasp the *modus operandi* of the theoretitician and research worker bent on opening new roads in the art of illumination. The utility of such a guide as the " E. Bogenlicht " hardly needs any comments. Indeed, the economical utilization of the voltaic arc as a source of light requires a thorough knowledge of phenomena belonging to various widely scattered branches of the tree of natural sciences. The book before us is a systematic and comprehensive treasury for the intelligent investigator and student. It is intended to supplement the more narrowly technical works treating arc light illumination.

The book starts with a general review of the voltaic arc phenomenon. The typical carbon arc is then described. The physical properties of typical materials used as arc light electrodes are discussed. The theory of gas discharges, spark discharges, relation between voltage and amperage in the arc and—the spacial distribution of energy in the arc (Raeumliche Vertheilung der Energie im Lichtbogenherd) is amply elucidated. The last chapter is devoted to the luminous efficiencies of various commercially important arc light systems.

The book is supplied with a bibliographical review of the literature of the subject.

Typographically the work is a model of art. The weak parts of the book are —the author's inclination to vague and unfounded generalizations and exaggeration of the importance of his own investigation at the expense of other cultivators of the field chosen by him. The bibliography is far from being complete. And yet " Das Electrische Bogenlicht " of E. Rasch is a welcome addition to the library of electric arc light engineering. It will teach its readers how to look for new things, if not how to find them.

Isador Ladoff.

Reflecting Glassware, by J. R. Cravath; *Electrical World,* July 29.

The writer particularly comments on the large number of new reflectors, at least reflectors bearing new names, which have been brought out within the past year or two. Speaking of opal glass the writer says:

> If opal were patented and could be pushed by some one company as a specialty or novelty at a good margin of profit without danger of competition, it would doubtless be much more popular than it is at present. Unfortunately it is so staple and well known that no manufacturer has seen fit to spend much money in pushing reflectors of plain opal for the simple reason that no exclusive trade can be built up with it.

This comment reminds one of the re-

mark once made by a great electrical expert in discussing the then newly invented electric lamp, that "if the candle were now being brought out for the first time it would be considered one of the greatest inventions of the age, being absolutely self-contained, portable, so simple as to defy misuse, and cheap enough to be within reach of all." Novelty is indeed a very essential quality for an article, from the commercial standpoint.

Speaking of sheet glass for daylight use the writer further says:

> Apparently there has not yet been produced a glass of low absorption, like acid-etched or sand-blasted glass, which can be obtained in plate form for use in sky-windows, lanterns, etc., but will have the smooth finish which makes effective cleaning possible.

The material for such glass is already at hand. Glass of the Alba, or "moonstone," type would fill the requirements admirably.

Illumination at Rochester, N. Y., in Honor of Mystic Shriners; *Electrical World*, July 29.

A short illustrated article on the night illumination during the recent convention of the Nobles of the Mystic Shrine.

Electric Illumination for Religious Festival; *Electrical World*, July 29.

Spectacular Illumination at Richmond, Ind.; *Electrical World*, July 29.

Festival of Light at Denver, Colo.; *Electrical World*, August 5.

Electric Lighting from Three-Phase Circuits, by G. P. Hoxie; *Electrical World*, July 29.

A short article on this interesting subject, accompanied by numerous diagrams.

Sapulpa Electric Light Welcome; *Electrical World*, August 12.

Foreign Street Lighting Data; *Electrical World*, August 12.

A Resistance Method for Obtaining the Instantaneous Performance of Incandescent Lamps, by Evan J. Edwards and George C. Conner; *Electrical World*, August 19.

An article illustrated with a number of curves giving the results of experiments carried out by the writers using a different method from other experimentators along the same line. The paper is highly technical and of interest only to students of pure science.

Sign and Outline Lighting by Tungsten Lamps; *Electrical World*, August 19.

Tungsten Fixtures on Chicago's Lake Front Boulevard; *Electrical World*, August 19.

Monochromatic Light and Visual Acuity, by M. Luckiesh; *Electrical World*, August 19.

A rather extended article with illustrations and tables describing in detail the results of experiments on visual acuity as affected by the composition of light. The writer takes issue with Dr. Bell in regard to some of his conclusions, particularly to that referring to the results obtained by the flicker and equality-of-brightness photometers. Comparisons were made of the mercury vapor light and light of similar color obtained by colored filters used with a tungsten lamp. Various methods of testing the acuity of vision were used, including that suggested by Dr. Ives in an article in the *Electrical World*, April 14, 1910. While the method of conducting the experiments is described in detail the results obtained are not clearly stated. It appears, however, that the general results of Dr. Bell's experiments were substantiated, and that pupillary contraction, which has been assigned by Dr. Ashe as a reason for the greater acuity with mercury vapor light, has no part in the effect. The experiments seem to show that the increased acuity of vision produced by the mercury vapor light is not only due to its monochromatism but also to its green color. The concluding paragraph is purely argumentative:

> While it seems to some that the acuity method is the only valid one, it must be remembered that in the case of general illumination the results obtained by this

method would not give a correct measure of luminosity. In the case of general illumination the eye, as a rule, is concerned with the vision of comparatively large surfaces which present a low degree of brightness-difference between one another, and not with minimal-sized detail presenting the highest practical contrast as reading print. The fact that monochromatic light produces a more distinct retinal image does not argue that it is the better light for constant use in distinguishing fine detail. This advantage may be more than offset by a possible destruction of the ability to discriminate colors. A thorough study of physiological effect of monochromatic light may show it to be more disturbing to the other functions of the eye than lights which more nearly approach in spectral character the natural light under which the eye has evolved.

This argument appears sophistical and hardly called for by the record of results of the experiments which forms the body of the paper. It is quite true that the degree of visual acuity of a given illumination does not numerically agree with its intensity; this is the one point which the experiments prove. This is a practical handicap in the application of photometric methods to illuminating engineering, since the final result of illumination depends upon the extent to which it produces satisfactory vision. It is also true that general illumination, which affords distant, or general, vision, does not require the acuity of near vision; but the quality of light which produces acuity of near vision by reason of its relieving the eye of the effect of chromatic aberration can certainly not impair general or distant vision; it must to some extent increase the acuity of all vision.

The statement that " the fact that nonchromatic light produces a more distinct retinal image does not argue that it is the better light for constant use in distinguishing fine details," is by no means self-evident, nor is it proven by the further statement that " this advantage may be more than offset by possible destruction of the ability to discriminate colors." The value of illumination where fine details must be distinguished is directly proportional to the acuity of vision produced in all cases except where colors must be distinguished in their daylight values, which forms a small minority of actual cases. While further investigation of the physiological effect of mercury or other nonchromatic light is of interest, it is hardly likely that any appreciable injurious effects could be produced and have escaped notice for the considerable period of years since the mercury light became commercially used, and in view of the thousands of people that have regularly worked under its light.

A theory is only an instrument for working out scientific truths, and inferences drawn from even the best of theories must not be taken as facts until they have been proven by results.

ELECTRIC WIRING AND ILLUMINATION OF LONDON AUTOMOBILE CLUB; *Electrical World,* August 19.

A short illustrated article on the wiring and lighting of the above named club.

GERMAN REGULATIONS FOR PHOTOMETRY OF ELECTRIC LAMPS; *Electrical Review and Western Electrician,* July 29.

A digest of the methods of photometry for electric lamps reported at the last annual meeting of the Association of German Electrical Engineers.

ELECTRIC LIGHTING OF A CANADIAN SLEEPING CAR; *Electrical Review and Western Electrician,* August 5.

SPECIAL ILLUMINATION IN DENVER; *Electrical Review and Western Electrician,* August 5.

A short illustrated article describing the illumination scheme recently carried out as a test of the electric lighting company's overload capacity.

ORNAMENTAL STREET LIGHTING SYSTEM FOR PEORIA, ILL.; *Electrical Review and Western Electrician,* August 12.

IMPORTANT CONSIDERATIONS IN FACTORY LIGHTING, by F. B. Allen; *Electrical Review and Western Electrician,* August 12.

The writer begins by an analysis of the elements entering into successful factory operation. His diagrammatic analysis of the conditions effecting efficiency of individuals in the producing department is clear, and more impressive than such diagrams usually are:

Efficiency of Individuals in Producing Departments depends on their

- Ability to work
  - Perception
    - Sight
      - Natural light
      - Artificial light
    - Sound
    - Touch
    - Taste
    - Smell
  - Intellect aided by
    - Education
    - System
    - Experience
  - Body aided by
    - Machinery and power to operate same
- Willingness to work
  - Conscious Will dependent on
    - Wages (Market Price)
  - Subconscious Will dependent on
    - Treatment
    - Conditions tending toward physical welfare
      - Correct light
      - Proper temperature
      - Ventilation
      - Sanitation

After his general analysis of the problem, which is both clear and logical, he argues with equal force on the necessity of providing good illumination for factory operatives, backing his arguments by figures showing the relative cost of light and labor, proving that the former is an insignificant matter in comparison with the latter. He sets forth the increased acuity of vision of the mercury vapor light as having an important bearing upon industrial work requiring observation of fine details, and cites cases where improved illumination has increased the output.

Ornamental Lighting at an Amusement Park; *Electrical Review and Western Electrician,* August 19.

Special Illumination During Minneapolis Civic Celebration; *Electrical Review and Western Electrician,* August 26.

Modern Street Illumination—Arc Lighting, by William Rawson Collier; *Electrical Record,* August.

An illustrated article on arc street lighting practice throughout the country.

The Methods of Lighting; Light as a Lubricant; a Practical Example; Poor Lighting Expensive to Manufacturers; How to Get Good Lighting; Influence of Light on Factory Output; *Selling Electricity,* August. (Industrial Lighting Supplement.)

Largely collated from various papers and bulletins.

Bowling Alley Lighting, by F. W. Loomis; *Journal of Electricity, Power and Gas,* August 5.

A short article accompanied by diagram illustrating one method of solving this very interesting problem.

Billiard Table Lighting, by F. W. Loomis; *Journal of Electricity, Power and Gas,* August 19.

A short article accompanied by diagrams showing two arrangements for solving the problem.

Principles of Illuminating Engineering, by A. G. Rakestraw, *Southern Electrician,* August.

This installment of the above serial is devoted to a discussion of electric incandescent lamps.

Pioneering in Electricity, by William A. Durgin; *Electric City Magazine,* August, 1911.

This chapter of the serial is devoted to the discussion of the bamboo light, discussing the origin and the status of the present incandescent lamps.

The Nature of Light Action in Selenium, by F. C. Brown; *Physical Review*, July.

Positive Potential of Aluminum as a Function of the Wave-Length of the Incident Light, by J. R. Wright; *Physical Review*, July.

Car Lighting; *Data*, August, 1911.

Commercial Interior Lighting, by L. N. Cummings; *Progressive Age*, August 1.

Interior Illumination with Small Units, by M. A. Bowlin; *Progressive Age*, August 1.

A short illustrated article describing the solution of the lighting of a billiard parlor with inverted incandescent gas lamps.

Ornamental Street Lamp Post Installation, by Glenn R. Chamberlain; *Progressive Age*, August 1.

A short illustrated article on the ornamental lighting installed by the Grand Rapids (Mich.) Gas Light Co.

Placing Gas in a New Factory Building, by Everett M. Hawley, *Progressive Age*, August 15.

A short illustrated article on illumination of a clothing manufacturer's plant lighted with incandescent gas lamps.

Lighting with the Single Burner Lamp, by A. H. Johnston; *Progressive Age*, August 15.

Gas Office in Indianapolis, by Philmer Eves; *Progressive Age*, August 15.

A short article, liberally illustrated, covering the recent installation of indirect lighting in the Indianapolis Gas Company's offices.

Methods of Window Lighting, by A. H. Johnston; *Progressive Age*, August 15.

Combined Window and Sidewalk Lighting; *Progressive Age*, August 15.

Concealed Lighting, by Thomas Morgan; *American Gas Light Journal*, August 14.

Factory Lighting, by E. Leavenworth Elliott; *American Legislation Review*, Volume 1, No. 2, June.

This article forms a part of the treatment of " Comfort, Health and Safety in Factories," which is the general subject of the pamphlet. A brief digest of the present provisions for lighting in the factory laws of the different States is given, as follows:

> Connecticut provides that factories be "well lighted," and that colored and corrugated windows may be removed if injurious to the eyes. Illinois requires halls, stairways, etc., to have lights kept burning whenever the building is in use. Maryland requires factories to be "well and sufficiently lighted." Michigan requires foundries to be "reasonably well lighted throughout working hours," and grinding and polishing cannot be done in basements unless sufficient light, heat, and ventilation are provided, as prescribed by the factory inspector. In Missouri, Rhode Island, Ohio, and New Jersey, if the Commissioner of Labor, or inspector, finds the heating, lighting, ventilation, or sanitary arrangements dangerous to health, he is to give notice to make necessary alterations. New York and Oklahoma require workrooms, halls, and stairways leading to them, to be properly lighted. Pennsylvania has the same requirements, together with the provision giving the inspector power to require alterations where lighting is not sufficient.

After discussing the relation of illumination to industrial accidents, the writer makes the following suggestions as a basis for the legislative regulation of factory lighting:

> It would be possible to divide all industrial lightting conditions into three divisions:
>
> First, all labor or operations in which the material worked upon is within arm's length. This would include all of the finer operations requiring sharp vision.
>
> Second, labor in which the material worked upon is at a greater distance than arm's length. This would include the rougher classes of factories, such as rolling mills, saw mills and the like.
>
> Third, storage rooms, yards and passageways.
>
> A certain minimum intensity of illumination should be required for each of these classes.

In conclusion, the writer maintains that reasonable requirements in regard to factory lighting would not be a burden upon the manufacturer but rather an advantage, since good and sufficient illumination more than repays its cost in the increased efficiency of the workman.

CONSERVING VISION; Edited by G. E. DE SCHWEINITZ, M.D., F. PARK LEWIS, M.D., LOUIS BELL, Ph.D., E. LEAVENWORTH ELLIOTT, B.S.

This is Bulletin No. 1 of the American Association of the Conservation of Vision, New York. It is of royal octavo size in large type on antique paper, and is a model of typography from the standpoint of visual hygiene.

The general topics treated are: Conserving Vision, Illumination, Structural Defects of the Eye, Accidents, Diseases of the Eye, The Conservation of Vision.

The discussion of illumination occupies seven and a half pages, and deals with the established principles of illuminating engineering with reference to effect upon the eyes.

The other topics are discussed in a thoroughly scientific but popular manner, the purpose being to give reliable information on these important matters that can be comprehended by the lay reader.

The bulletin is distributed free to members of the association. To others, single copies are 25 cents.

Editorials

PRESERVATION OF EYE SIGHT; *Electrical World*, August 5.

ORNAMENTAL STREET LIGHTING; *Electrical World*, August 19.

A RESISTANCE METHOD FOR OBTAINING THE INSTANTANEOUS PERFORMANCE OF INCANDESCENT LAMPS; *Electrical World*, August 19.

THE PRIMARY STANDARD OF LIGHT; *Electrical World*, August 19.

THE FUTURE OF THE ELECTRIC SIGN; *Electrical Review and Western Electrician*, July 29.

FACTORY LIGHTING; *Electrical Review and Western Electrician*, August 12.

SIGN LIGHTING; *Electrical Review and Western Electrician*, August 19.

RATING OF SHADES AND REFLECTORS; *Electrocraft*, August.

THE BEST LIGHT FOR THE EYES; *Optical Journal and Review*, August 3.

OFFICES AND INDIRECT ILLUMINATION; *Central Station*, August.

Foreign Items

COMPILED BY J. S. DOW.

Illumination and Photometry

DISTRIBUTION AND EFFICIENCY TESTS OF LAMP SHADES AND REFLECTORS, by H. Murphy and H. L. Morgan (*Elec. Review*, July 7, 14).

The authors describe a series of tests on opal, prismatic and silvered glass reflectors, arriving at the unexpected conclusion that the percentage of light reflected under the best conditions is about 80 per cent. in each case. They state, further, that with bare lamps about 30 per cent. of the light is normally available at the table level, and that by suitable shades this may be increased to 50 or even 65 per cent. They also point out that if the illumination is not below a certain value a considerable "diversity factor" may exist without the eye becoming aware of the lack of uniformity.

ÆSTHETISCHES VON FESTBELEUCHTUNGEN, by H. Pudor (*Z. f. B.*, June 30).

The author deals with the production of æsthetic and spectacular effects in exterior lighting. He suggests that, judging from the artistic standpoint there has been too close an imitation of the architectural features of buildings by outlining, and that the imitation of rosettes, flowers, etc., with incandescent lamps is essentially inartistic.

The variety of lamps now available provides scope for better methods of decorative lighting, but extreme regularity in their arrangement is to be avoided.

Globes, Shades and Reflectors, by C. Toone (*Elec. Review,* June 16, 23, 30).

This article summarizes the information available from various authors in an exceptionally complete manner. He commences by compiling a table, showing the intrinsic brilliancy of a number of artificial illuminants and the ratio of their intrinsic brightness to the permissible hygienic value. Subsequently he tabulates the illumination required in various classes of interiors, and gives data regarding the light absorbed by various types of shades and reflectors, and the effect of dust. The remainder of the article deals in a general manner with the principles of lighting, discussing the best means of avoiding glare, the arrangement of lamps for various practical purposes, etc.

Licht Kommission, by W. Wedding (*E. T. Z.,* July 6).

Gives some particulars of the work of the sub-committee of the Verband Deutscher Elektrotechniker on Photometry. Researches are being carried out with a view to discovering the best form of diffusing white plate for illumination photometers, material for coating the inside of the Ulbricht globe, etc. Problems connected with color and the comparison of heterochromatic lamps will also have to be considered shortly.

A State Committee on the Hygienic Aspects of Lighting (*Illum. Eng.,* London, August; *Le Moniteur de l'Industrie du Gaz.,* etc., June 30).

Refers to a very important announcement that the French Government have determined to appoint a special committee to deal with the hygienic aspects of lighting. On this committee distinguished oculists, and also gas and electric engineers, inspectors, etc., will serve. It will include among its objects the study of the amount of light required for various industrial purposes, its effect on the eyes, the measurement of illumination, etc.

The Coronation Illuminations (*Illum. Eng.,* London, August).

An illustrated article describing the Coronation illuminations in London. It is pointed out that, although the illuminations were on an unprecedentel scale, there was little very novel to record. There were instances of ingenuity in some illuminated devices, and the lighting of the front of White's Club by concealed Holophane picture lighting reflectors is specially mentioned.

Restaurant Lighting (*Illum. Eng.,* London, August).

It is pointed out that there are two distinct varieties of lighting for restaurants, that for casual diners who make a rapid meal, and that intended for regular diners out who propose to spend a longer time over their dinner and to use it as an opportunity of meeting friends, etc. In the first case a bright and cheerful general illumination is desired; in the second case something more subdued and of a "cosy" nature. This is illustrated by some photographs of the illumination of the Cabins Restaurants (London), in which both methods are used.

Illumination of Caves and Grottos (*Illum. Eng.,* London, August).

Points out the value of cunningly arranged lights in show caves and grottos, etc., as a means of showing up the stalactites and enabling all the objects of interest to be seen. This is illustrated by an account of some caves at Cheddar (England).

Shop Front Lighting. The Standardization of Street Lighting Specifications (*J. G. L.,* August 8).

Perfectly Diffused Light (*Elec. Times,* July 6).

Light and Heat in Artificial Illumination (*J. G. L.,* June 24).

Standard Specifications for Street Lighting (*G. W.,* July 8; *J. G. L.,* July 11).

Electric Lighting

Les Lampes à Filament Metallique, by Bourrelly (*Soc. Belge Elect. Bull.*, May 28).

Describes some forms of lamps with tungsten filaments, termed "Leila," which are stated to excel the ordinary makes, both in strength and durability, and in the way the light is distributed. This improvement is said to be accomplished by the method of mounting the filament. In some cases horizontal filaments are employed, in others a combination of horizontal and vertical filaments, and in others a form in which the filaments all converge to a point.

Die Elektricitàt im Hause, by G. Dettmar (*E. T. Z.*, June 29, July 6).

Municipal Electrical Engineers and Gas Competition (*G. W.*, July 8; *J. J. G. L.*, July 4).

Coronation Electric Illuminations. An Illuminated Tramcar (*Elec. Review*, July 7).

Gas, Oil, Acetylene Lighting, etc.

Recent Advances in the Manufacture of Incandescent Mantles, by C. R. Böhm (*Illum. Eng.*, London, August).

A technical description of various improvements in mantle winding machines, methods of impregnation and sewing the webs of mantles, etc.

Street Lighting from a Practical Point of View, by H. E. Copp (*G. W.*, July 8).

A considerable portion of this paper is devoted to a discussion on the relative merits of upright and inverted mantles for street lighting. The question of the shaping of reflectors for street lamps is also receiving attention. These should be convex, so as to distribute the light sideways and not concave, which would lead to the light being focused downward immediately below the lamp. The author has also been experimenting with a form of dioptric globe for gas lamps.

High Pressure Gas Lighting on the Continent (*J. G. L.*, June 27).

Coronation Gas Illuminations (*J. G. L.*, June 27).

Direct and Distance Electric Lighters for Incandescent Burners (*J. G. L.*, June 27).

A Provincial Gas Illumination Scheme (*J. G. L.*, July 4).

VI Internationale Kongress für Karbid und Acetylen in Wien (*J. f. G.*, July 1).

Neuere Brennerkonstruktion für Stehendes Gasglühlicht (*Z. f. B.*, June 30, July 1).

Parade or Scale Lighting (*J. G. L.*, June 27).

Contractions used:
E. T. Z. *Elektrotechnische Zeitschrift.*
G. W. *Gas World.*
Illum. Eng. Lond. *Illuminating Engineer* (London).
J. f. G. *Journal für Gasbeleuchtung und Wasserversorgung.*
J. G. L. *Journal of Gaslighting.*
Z. f. B. *Zeitschrift für Beleuchtungswesen.*

The Illuminating Engineer

Vol. VI OCTOBER, 1911 No. 8

WORK AND WAGES

"The Laborer is Worthy of His Hire."

Civilization differs from savagery in that a large part of the labor of the civilized individual is performed directly for others, while the savage works exclusively for himself. The farmer eats but a trifling portion of the produce which he raises; the shoemaker perhaps never wears a pair of shoes on which he has worked; and the lawyer who tries his own case proverbially has a fool for a client.

The labor performed directly for the benefit of others must be returned in labor performed by others for us. Even the poorest of us have the whole world working to supply our needs.

For his labor the individual receives a wage which is the measure of the labor of others which he may receive in return. Hence, the continual effort of the laborer to receive the highest wage possible. High cost limits demand, thus introducing an automatic balance to the self-multiplying process between the rate of wages and cost of the products of labor.

No artificial disturbance of this balance can ever secure any permanent good. To simply raise the rate of wages amounts in the end to nothing more than multiplying both dividend and divisor by the same number, which does not change the value of the quotient—the rate of wages being the dividend and the cost of living the divisor.

The only method of permanently increasing the general good is by either increasing the dividend or diminishing the divisor, i. e., by either increasing the efficiency of labor, or decreasing the requirements of living. While the latter may be accomplished to some extent by cutting off luxuries, it is to the former that we must look for all great improvement in human welfare.

Anything that adds to the efficiency of labor, which enables it to accomplish more or better work with an equal or less outlay of physical and mental effort, is a distinct forward step in the march of civilization.

Among the changes effective in increasing the standard of human efficiency none is more to be considered than light. If the same factory, with the same men, machinery, and materials that has turned out a $1,000 worth of product a day can, by improving its illumination, turn out $1,100 worth in the same time, then society has been directly enriched at the rate of $100 a day, and this additional wealth will distribute itself through the natural channels to every individual. With the increase the workman, if he chooses, can purchase a corresponding portion of his own labor—in other words, may shorten the hours of work.

Providing the best possible illumination for the worker is not a gain in the gambler's sense of taking money from another, but in absolutely increasing the sum total of human wealth, in which the manufacturer and laborer must, by the laws of society, mutually share.

LET THERE BE MORE AND BETTER LIGHT!

E. L. Elliott.

FIG. I.—GRACE EPISCOPAL CHURCH, JAMAICA, N. Y., SHOWING EFFECT OF THE NEW CONCEALED ILLUMINATION.

Church Lighting

By J. L. Wiltse.

The following is a description of a recent installation made in Grace Episcopal Church, Jamaica, N. Y.:

This is an old church built in 1861, and the architecture is of the early English Gothic style. It is built of stone, and the inside walls are plastered on the stone. The auditorium is 50 ft. wide and 80 ft. deep. The roof is supported by ten Hammer beam trusses (five on each side), about 20 ft. above floor and projecting out 6 ft. from side walls. The two rear trusses being flush with back wall. The chancel is 25 ft. wide and 40 ft. deep. The auditorium has been lighted by open flame gas jets on brackets along sidewalls, and the chancel by a large corona fixture containing about fifty gas jets. This method of gas lighting was very poor on the eyes.

When they decided to install electric lighting, the usual question came up as to what method of lighting to adopt. The expense item was one which had to be considered both as to cost of installation and cost of lighting. Due to the construction of the church, the wiring was one which had to be considered in the method of illumination. Most important, however, was what form of lighting

should be adopted, which would show off the architectural features to the best advantage, and be restful to the eye.

For the auditorium there were two methods of lighting suggested; one to hang a fixture from each of the eight beams and the other to place two one-light brackets containing 100-watt tungsten lamps on the chancel side of each of the ten beams. The lamps to be placed so that the light source was not in the vision of the people in congregation. In order to convince the vestry that the latter was the best form, a demonstration was made of each of the above forms, with the result that the semi-concealed system was installed.

The brackets for this system were placed as follows: One 18 in., and the other 36 in. from end of beam. They were equipped with Holophane intensive reflectors, and placed so that the bottom of the reflector did not hang below the beam. The lamps are hung at a slight angle toward the front and centre of church. There are 20 100-watt tungsten lamps.

This gives a uniform illumination throughout the auditorium, and the result is beautiful and very effective.

There are four switches, one for lamps on first, third and fifth beams, one for second and fourth, and the other two for corresponding lamps on opposite side.

The lighting of the chancel is obtained by two 7-ft. strips of Frink reflectors, each containing six 40-watt tungsten lamps. These are placed behind the chancel arch, one on each side, placed about 6 ft. below the point of arch. Below these reflectors there are placed on each side two 40-watt tungstens, equipped with 45-degree reflectors. These are installed principally to furnish light to the choir. They are on a separate switch, and can be used on dark days when the other lights are not required. In the rear of chancel on the altar are two dormer windows, one on each side, in which there is placed a 60-watt tungsten, equipped with Holophane focusing reflector. These furnish light at the altar, and avoid the shadow, which would be on the minister's book when his back is to the other chancel lights.

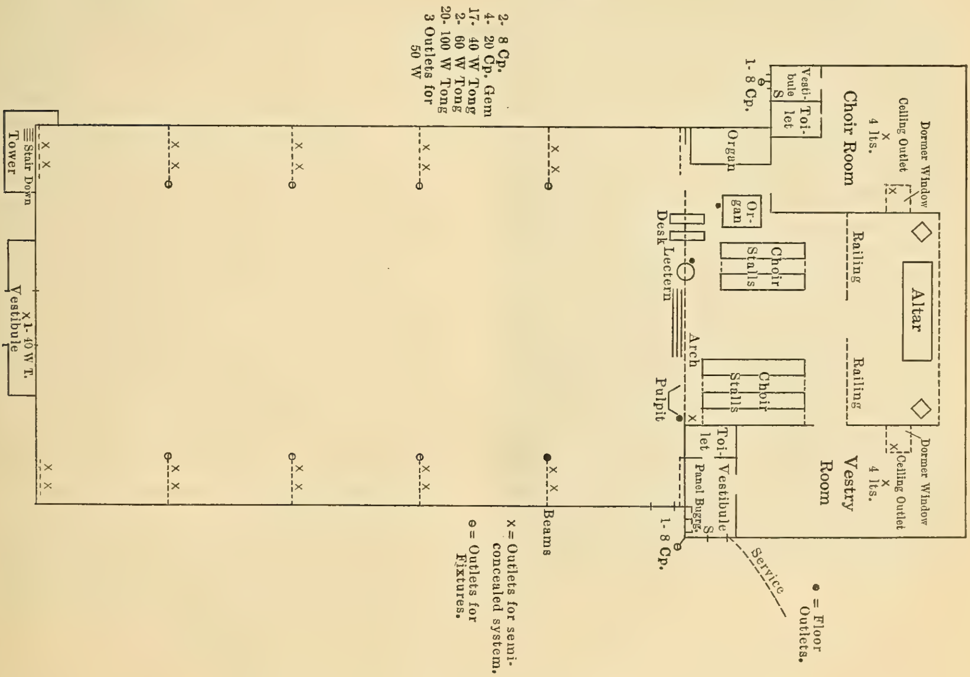


FIG. 2.—PLAN SHOWING ARRANGEMENT OF LIGHTING EQUIPMENT.

The lighting of both the chancel and auditorium is very good, and is also very effective and beautiful.

The other parts of church are also lighted by electricity, of which no special mention need be made here.

Lemuel Robert Hopton

The news of the death of Mr. Hopton, on September 5, came as a severe shock to all who had shared his acquaintance, even to the extent of familiarity with his published contributions to the subject of illuminating engineering. The feeling of bereavement was intensified in the minds of those who enjoyed his personal friendship by the picture of health and energy which he always presented as conspicuous elements of his personality.

Mr. Hopton was slightly more than thirty-eight years of age at the time of his death, having been born on June 20, 1873, at West Stratford, Conn. He was prepared for Yale University in the New Haven High School, and graduated from the Sheffield Scientific School in 1896 with the degree of Ph.B. He tutored at Yale for two years, receiving at the end of this time the degree of M.E. He later associated himself with the Enos Company, the well-known fixture manufacturers of New York, as superintendent, in which capacity he was engaged at the time of the formation of the Illuminating Engineering Society. His scientific training and turn of mind naturally enlisted his attention in this new science, which he took up with enthusiasm and energy. That he acquired intimate knowledge of the technology of the subject and possessed unusually broad views as to its scope and purpose are amply shown by his contributions to the society and to the technical press. He was made illuminating engineer for the Enos Company, the company thus having the distinction of being the first fixture manufacturer to recognize the science and profession. He was largely instrumental in developing the reflector known under the trade name of Opalux, and invented a number of useful and practical devices in connection with lighting apparatus.

MR. LEMUEL ROBERT HOPTON.

In his personality Mr. Hopton was genial and considerate, maintaining his opinions, which were always well defined and positive, with a sincere earnestness and a broad-minded spirit of tolerance. His nature was simple and genuine, and invariably endeared itself to all who came within its influence.

His death is a distinct loss to the science and profession of illuminating engineering. Mr. Hopton leaves a widow and two sons.

Considering the Illuminating Engineering Society

By Albert Jackson Marshall.

It has long been realized that the production and application of light involves more than the consideration of what may be termed the physical features. This is evidenced by the fact that a number of societies and associations include the subject of light and its application in their topics, displaying a deep interest therein.

The American Association for the Conservation of Vision is endeavoring to effect methods and conditions in the use of light whereby vision may be conserved.

The American Electro-Chemical Society is interested in the production, rather than the application of light.

The American Gas Institute is interested in the production, distribution and use of gas, partly as applied to producing light, and its effect—illumination.

The American Institute of Architects, and other societies having to do with similar or associated work, who for the most part are interested in the application of light from the esthetic viewpoint.

The American Institute of Electrical Engineers, who, for a numbers of years past, have considered certain phases of light, principally the physical side as related to electricity.

The American Opthalmological Society, who have investigated the effect of light on the eye.

The American Psychological Association, whose members have considered the effect of color on the brain.

The Association of Car Lighting Engineers, recently renamed the Railway Electrical Engineers, whose object at the time of incorporation was to consider the use of artificial light as applied to railroad cars.

The International Acetylene Association has for its object, among other interests, the consideration of acetylene as a means of producing light, and its application to practical requirements.

The National Commercial Gas Association, which has approached the subject both from the commercial and scientific sides, but usually confining its investigations to that which might properly be classified as the physical side, although quite recently other phases have received some slight consideration.

The National Electric Light Association, as its name would imply, is interested in electrical illuminants; their creation and methods of application.

The New York Electrical Society, whose investigations have mostly to do with the use of electric illuminants.

The Society of Gas Lighting, interested as its title signifies.

There are several other associations, by no means omitted from lack of appreciation, part of whose efforts are given to the study of some one or more phases of the use of light, which not only indicates the breadth of the subject, but the thought that is being expended on the different phases, *strictly as phases,* however, and not necessarily considering the relation of one phase to another. For the most part the various societies who consider light and its application attempt to treat with some one particular phase of the subject, which, while probably productive of much important, specific data, nevertheless lacks breadth, through lack of association with some more or less relatively important phase.

We now come to a society, founded about five years ago, whose object was to consider the art and science of light in *all* its numerous branches rather than to emphasize any single phase. The Society I refer to is the Illuminating Engineering Society. This society differs from the aforementioned associations in that its sole object is the consideration of problems associated with light, natural and artificial, whereas the associations referred to deal with light only as it is related to the particular subject with which they are most concerned. For instance, the American Institute of Electrical Engineers are interested in electricity, and as electricity is a means of producing light, light has been considered. The American Opthalmological Society has studied the physical

structure and hygienic functions of the eye, and as light here plays an important part, its relation and effect upon the eye has been considered. The American Institute of Architects and other associated interests, including decorators, designers, fixture manufacturers, etc., have been primarily interested in the esthetic phases of illumination. The American Psychological Institute has been interested in matters pertinent to the relation of light to the brain, and other psychological phenomena.

The Illuminating Engineering Society was organized to bring under one head *all* interests involved in the subject, which would number among its members persons representing every phase of the art and science of illumination, and to so conduct its researches and investigations *that each interest would bear the proper relation to each and every other interest.* While the Illuminating Engineering Society has done much for the advancement of the art and science, its activities have been almost as much confined to the consideration of a few, rather than all the features involved, as the work of the various associations previously mentioned. So far, the physical side of the subject has been in most cases the only topic of real study in the society, and those members who are primarily interested in this phase have regulated its affairs. Progress of a meritorious order has unquestionably been made along certain lines, but greater accomplishments are easily attainable with some readjustment of policy.

On several occasions I have attempted to set forth my views regarding the activities, management and probable future of the Illuminating Engineering Society (of which I have the honor of being a charter member), to the council of the society. My object was, and is, to broaden the scope of its activities, and help make it the great influence it should be in the broad field it covers. While my suggestions have been courteously received, they have not formed a basis for the extended action which I deem desirable for the welfare of the organization. As the Illuminating Engineering Society is dealing—or attempting to deal—with a subject which is of vital interest to mankind in general, and the lighting world in particular, I feel thoroughly justified in setting forth some of my ideas regarding the use of light to those progressive and broad-minded individuals whose opinions are of value. Realizing that I will be subjected to criticism, at least momentarily, by some for taking such action, I feel nevertheless that, after mature thought, the representative section of the lighting world will appreciate the motive prompting such action, and will see the value that will ultimately result if proper adjustments are made to meet present and future requirements. In making such comments on the Illuminating Engineering Society and its activities I desire it to be thoroughly understood that *I fully appreciate the vast amount of excellent work which this society has accomplished,* and that, moreover, I am proud of being associated with it as a member—and, for about three years, as an officer of one of its sections. I believe, however, that the Illuminating Engineering Society is capable of far more extensive, broad and useful work than it has accomplished, and trust that the discussion brought up by this paper may afford suggestions which, if acted upon by the management of the society, will prove beneficial.

In March of this year I wrote the council of the Illuminating Engineering Society, stating that, in my opinion, there was less general interest displayed in the happenings of the society than there was two or three years ago. *It is to be understood that I do not say less interest displayed in matters pertaining to the use of light, for the subject is to-day receiving far greater consideration than ever before.* This statement, at first, may appear questionable, but is substantiated by records of fact. There is little or no doubt, in my mind, that the Illuminating Engineering Society is relegating itself to an entirely different position than that which it started out to acquire; and further, it will be only a matter of time when the activities of the society will be confined strictly to scientific (physical) researches, and the several other important phases involved in the use of light will be handled by other associations, if the society continues its present policy.

One of my reasons for stating that there is apparently less interest displayed in the happenings of the society now than two or three years ago, is due to a study of the number and character of persons attending the sectional meetings, and the discussions which ensue. As an illustration, the New York Section last year—1910—had an average monthly attendance of 65, including members and guests, at which meeting 18 papers of widely diversified topics reflecting almost all phases of the subject, were read. This attendance, which is small considering the membership assigned to the New York Section—about 500—and in view of the interest existing in subjects relating to light, was obtained only by the most strenuous efforts on the part of the managers of the section; for, besides the regular post card notices, considerable telephoning and much personal solicitation was necessary in order to create and sustain interest. In Chicago the average monthly attendance out of about 350 assigned members was 45. The New England Section, with approximately 125 assigned members, had an average monthly attendance of 25. The Philadelphia Section could boast of an average monthly attendance of 85, with an assigned membership of approximately 375. In Philadelphia the membership, for the most part, is made up of representatives of the gas and electric interests, and is therefore easier to control than the general membership in the other cities indicated.

Without attempting to generally compare the attendance figures given in the foregoing paragraph with those of several other societies, let us note the attendance of but one of the societies dealing with the subject of light, namely, the National Electric Light Association, which deals with the *commercial,* and *some* phases of the *scientific.* The New York Section of the N. E. L. A., which was regularly organized but a few months ago, now has an average monthly attendance of over two hundred. The enthusiasm displayed at these meetings has been truly remarkable; and unless one arrives early, one is not likely to secure a seat, and many "standees" have been observed at these meetings—something almost unheard of at a section meeting of the Illuminating Engineering Society. Very few of those attending the N. E. L. A. meetings in New York attend the meetings of the New York Section of the Illuminating Engineering Society, although invitations have been extended. Some of those attending these N. E. L. A. meetings have remarked to the writer that, at their meetings, they get the sort of information that is of greater value to them in the use of electricity as a means of producing light; that the restrictions in regard to "commercialism" are not so rigidly enforced, thereby permitting of a free, intelligent, constructive discussion, which brings out much valuable data which is advantageously employed by the members in their daily work. A very practical feature in connection with the association referred to that is of great importance and should not be overlooked, is that those attending the meetings are responsible for the lay-out of many lighting installations. These installations may not be large—the large installations are usually designed and installed by architects and fixture houses, who are conspicuous in the Illuminating Engineering Society by their absence—but *they are* installations.

What the Illuminating Engineering Society needs are men who not only have original ideas, *but who are in a position to carry out their ideas into practical effect.* The ideal condition would consist in having a common meeting ground where theories could be advanced and analyzed, and their good points incorporated in lighting installations by those who have jurisdiction over such work. This condition, unfortunately, does not exist in the Illuminating Engineering Society. We have a goodly number of persons who advance some excellent ideas; but we have few, very few persons as members, who are in a position to put their ideas into practice. This point, I feel, is a most important one, and is worthy of thought.

Let us review table I showing the membership classification of the Illuminating Engineering Society.

An analysis of the table will prove very interesting. Reference will be made here to only two or three features. It will be noted that architects, who have

TABLE I.

Industry or profession with which connected	Total numbers.	Total per cent.	Total of groups.	
Electric Lighting—				
Central stations	322	21.0		
Industry in general	223	14.5		
Lamp manufacturers	168	11.0		
Apparatus manufacturers	142	9.3		
Consulting engineers	47	3.1		
Contractors	31	2.0		
			933	61.0
Gas Lighting—				
Gas companies	245	16.0		
Lamp manufacturers	27	1.8		
Industry in general	38	2.5		
Acetylene gas and lamp manufacturers	3	0.2		
			313	20.5
Gas and electric lighting	13	0.8	13	0.8
Illumination in general—				
Globe and reflector manufacturers	78	5.1		
Fixture manufacturers	5	0.3		
Consulting illuminating engineers	4	0.3		
			87	5.7
Miscellaneous—				
Pedagogic	72	4.7		
Technical journals	18	1.2		
Research and testing laboratories	23	1.5		
Architects	13	0.8		
Scattering	13	0.9		
Unclassified	45	2.9		
	1,530	100.0	184	12.0

NOTE.—Table taken from the General Secretary's Report to the Council for 1910, appearing on page 60, Vol. 6, No. 2, February, 1911, Transactions of the Illuminating Engineering Society.

jurisdiction over most of the representative buildings and lighting installations therein placed, have 13 representatives out of a total membership of 1,530, or approximately 0.8 per cent. It will be further noted that there are five fixture manufacturers' representatives, or 0.3 per cent. of the total membership. Without in any way attempting to argue for or against the architects' and fixture manufacturers' knowledge of matters relative to lighting, but looking at the matter from a purely practical viewpoint, weakness is evident; for between the architects and fixture manufacturers the great majority of lighting installations are designed and installed. The significance of this fact is well worth appreciating. Leaving entirely out of the question the fund of knowledge which these two classes have on the subject as a result of their extended experience, would it not be desirable to enjoy their co-operation, if for naught else than the tremendous influence they wield in the vast field over which they are masters? Without a doubt architects and fixture manufacturers would become associated with the society, and work for its cause, provided, if their affiliations were equitably effected, so as to be mutually beneficial. The Illuminating Engineering Society, or more properly speaking, a portion of its members, have made it so evident that the physical side is all important and the esthetic elements of only minor importance, and that the architect and fixture manufacturer are responsible for all that was undesirable in lighting without giving them credit for much that has been done which is truly good and elevating, that the architects and fixture manufacturers have not seen fit to associate themselves with the society.

It will be noted that there is a scarcity —almost a total lack—of opthalmologists and psychologists among the members of the Illuminating Engineering Society; although even those whose knowledge of the subject of light is not yet far advanced must realize that the eye and brain come first, before the question of lumens, foot-

candles and the like. There was a time, amongst a certain class, when the value of a lighting system was measured in effective (physical) lumens per watt, with little or no consideration for other more important factors involved. The value of a lighting system is determined to-day—as heretofore, by those who appreciated the true scope of the work—by its "visualizing efficiency"; and no matter how efficient a system may be, measured on a purely physical basis, it cannot be "approved" until its effect on the eye and brain has been found to be acceptable to these vital organs. This "visualizing efficiency" takes precedence over all other considerations. Therefore it is evident that opthalmologists, psychologists and others interested in such branches are needed, and needed badly, by any association whose object is to improve lighting conditions.

The Illuminating Engineering Society is not taking the active part in the physiological, psychological, esthetic and commercial phases of the subject that it should, and is fast losing any control which it might have exercised over these different branches. This condition has been brought about largely by its own efforts; and those who are in a position to actually understand what is going on in the lighting world realize that the foregoing conclusion is inevitable unless radical changes are made in the policy of the society. The need of a deep, thorough, recreative movement, with developments along lines in keeping with progress, is evident to the initiated.

The Illuminating Engineering Society should be made up of architects, decorators, designers, fixture manufacturers, physicists, physiologists, psychologists, engineers, oculists, chemists, and those interested in the exploitation of electrical, gas, acetylene and oil lighting products and accessories. The subject of the use of light should be approached in a broad-minded manner in keeping with its great breadth. Such, however, has not been the working policy of the society; and it cannot hope to be the controlling factor in such diversified interests, unless they are actually numbered among its membership, and properly represented in the management, making it possible for all phases of the subject to receive proper consideration.

Let us review the personnel of the society since its incorporation in 1906. We find that of the six presidents elected to date, that 4 have been engineers and 2 physicists. Of the 100 members going to make up the six councils, 42 have been engineers, 15 central station representatives, 12 physicists, 12 editors, 6 reflector manufacturers' representatives, 4 chemists, 3 gas company representatives, 2 gas and central stations representatives, 1 electrical accessories manufacturer's representative, 1 gas illuminant representative, 1 fixture manufacturer's representative. It will be noted that 66 per cent. of the number of presidents have been engineers, and that 42 per cent. of those going to make up the six councils have been engineers; and if we take engineers and those closely related to such profession we find *all of our presidents in such class, and considerably over one-half* of those going to make up our councils *representing physical conditions involved in the work.* It is, of course, but natural that such management would elevate the physical side, rather than the other important divisions going to make up the art and science in its entirety.

While the Illuminating Engineering Society is supposedly composed of such diversified interests as indicated, it will be noted that but *few of these interests are, or have been, represented in the management of the society,* and as a matter of fact, *there have been no architects, no designers, no decorators, no physiologists, no phsychologists, no oculists, in the councils of the society.* Without the guiding influence of such representatives, is it to be wondered that the society has not a firmer grasp on the situation? The answer is evident. The remedy is simple.

In table II is indicated the character of papers included in the first five volumes of the Transactions of the Illuminating Engineering Society.

From a casual inspection of the following table one might be led to believe that the "breadth" spoken of in this article as being lacking in the Illuminating Engineering Society was, in reality, pres-

TABLE II.—Character of Papers Included in First Five Volumes of Transactions of Illuminating Engineering Society.

Of more particular value to those interested in

Papers dealing with—	Acetylene lighting	Architecture.	Calculations.	Daylight.	Electric lighting.	Fixtures.	Gas lighting.	Illuminating Engineering.	Illuminating oils.	Pedagogy.	Photometry.	Physics.	Practical research	Standards and units.	Street lighting.	Vision.
Acetylene lighting	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Architecture	..	6	..	..	..	..	..	6	..	..	..	..	..	..	..	..
Calculations	..	..	14	..	..	..	..	7	..	..	..	..	..	1	..	..
Daylight	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..
Electric lighting	..	2	..	..	16	..	1	5	..	..	2	1	..	..	2	..
Fixtures	..	..	..	..	..	9	1	5	..	..	..	..	..	..	..	..
Gas lighting	..	..	..	..	..	..	16	8	..	..	..	..	..	1	..	..
Illuminating engineering	..	1	2	1	3	..	1	52	..	..	4	2	1	..	..	1
Illuminating oils	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..
Pedagogy	..	..	..	..	..	..	..	2	..	2	..	..	..	..	..	..
Photometry	..	..	..	..	1	..	3	11	..	..	16	1	..	..	..	..
Physics	..	..	..	..	1	..	3	2	..	..	2	8	..	..	..	..
Practical research	..	..	..	2	1	..	..	4	..	..	1	1	7	..	..	..
Standards and units	..	..	..	..	..	..	1	1	..	..	2	..	..	9	..	..
Street lighting	..	..	..	..	4	1	4	..	..	..	1	..	..	..	15	..
Vision	..	..	..	..	..	..	..	2	..	..	1	1	..	..	..	12
Total	2	9	16	4	26	10	30	106	1	2	30	14	8	11	17	14

NOTE.—Table taken from the General Secretary's Report to the Council for 1910, appearing on page 61, Vol. 6, No. 2, February, 1911, Transactions of the Illuminating Engineering Society.

ent; and to be just, one must appreciate the fact that quite a wealth of papers is represented. But aside entirely from a consideration of the character of these papers, it must be admitted that the *esprit de corps*, or co-operation is to a large extent lacking. It is one thing to have a paper presented, and quite another to have such a paper appreciated and acted upon to the full extent of its intrinsic value.

As I have before stated, the society must, to my mind, do one of two things: either establish itself as an organization primarily interested in the purely scientific features associated with the creation and utilization of light, with a membership of what would probably be a mere fraction of what it now enjoys; or to make the society attractive to representatives of *all* interests involved in the work, giving each good reason to feel that he will be properly represented in the managing council of the society. This latter mentioned organization would probably permit the establishment of two or more classes of membership, a possibility which has been discussed for incorporation in the society as it now stands. Such idea, however, has not been adopted, as the present conditions of the society seem to make impractical the adoption of same. If either of these two alternatives should be adopted, the society would act, to a greater or lesser extent, as a clearing-house for all ideas and features associated with the use of light, natural and artificial.

It would be possible to enumerate a goodly number of reasons why lighting work should be approached in a broad-gauged manner, some of which, I think, are understood by everyone having to do with modern illumination design; but this article has already assumed larger proportions than was desired by the author.

It is to be hoped that no one, in reading this article will infer that the writer is unappreciative of the work that has been accomplished by the Illuminating Engineering Society, or what can be accomplished, even if the society continues its

present policy, for I fully realize what such accomplishments mean.

The author's idea of a satisfactory lighting installation is one of such nature that the eye and brain can properly perform their functions with the least effort; that the equipment shall be in perfect harmony with its environment; that it employ strictly efficient illuminants and such accessories as permit of economic maintenance. Those who approach the subject in this manner are desirable candidates for membership in the Illuminating Engineering Society. In order to educate the public we need all the assistance that those persons representing various phases of the work can lend, whether they be specialists, or dealing with the subject generally. If we can bring together all these representative interests in a common body, so that we will be working for a common cause, it does not require any great stretch of imagination to realize the resultant value that such co-operation will make possible.

Some agency is going to bring about these conditions ultimately—why not the Illuminating Engineering Society?

Legislative Regulation of Illumination

By Davis H. Tuck.

The term physics embraces all the natural phenomena concurrent with the universe, and when it is noticed what a large part of every text book, covering physics, is taken for a discussion of luminous energy one cannot but be impressed by the fact that scientists have studied and comprehend this particular phase of physics more thoroughly than any other part.

In this age of applied science our great corporations have profited by following closely on the investigations of the technical institutions. One will find organizations dealing particularly in each of the fundamentals of physics, mechanics, heat, sound, electricity and light. The only aim of the companies dealing in light has been to produce light and sell it; they have made no provision for its distribution and utilization. The customers do not realize, as the savages do, what a dangerous thing they are buying and spreading carelessly around their homes. The entpreneurs know and the public service commissions know the danger of light improperly used, and yet they make no provisions by which the people may be protected. Anesthetics are useful and necessary, yet their sale is guarded by law and the manner of their uses fixed by the laws of the States. Why do not these same authorities provide restrictions for the sale, for improper use, of light?

To solve any physical problem we can do no better than study nature and copy, as nearly as may be, what we observe. In daylight there are no luminous bodies in the field of vision. The sun is so placed as to give light by the method of indirect illumination, and when in its courses it becomes necessary to thrust itself into our line of vision, nature has provided the dust laden atmosphere to dampen out its glare.

When our laws demand universal indirect illumination, not only esthetic but physical advantages will be derived. When a person wishes to think or to rest he will invariably seek a place that is indirectly illuminated. With this in mind why do we persist in placing a glaring ugly object directly in front of our eyes? The answer is not that we know no better, for we do know better. The only answer that we can give is that we did not realize how much we were endangering our health, progress and happiness by so doing. It is full time that every one realized the danger of light improperly used, and relieve themselves from a large part of their physical and mental anxiety and their children from the curse of poor eyesight and disagreeable temperaments.

An Ornamental Street Lamp Post Installation

By Glenn R. Chamberlain.

The Grand Rapids Gas Light Company, Grand Rapids, Mich., has just completed the erection of seven beautiful street lamp posts which are a decided ornament to the corner on which the company's offices are located. Four of the posts are on the Pearl Street and three on the Ottawa Street side of the building. From the two arms of each post are suspended two five-burner, white enameled inverted gas arc lamps with alabaster ball globes. The arms of the posts, instead of being at right angles, as generally installed, have been placed parallel with the curbs, and thus form a row of 14 powerful lamps around the building.

The posts themselves, as will be seen from the illustrations, are of classic design, massive and well proportioned, and sufficiently tall to insure a perfect distribution of light. They are the first posts of this design or style ever used for gas street lighting, and are perhaps the handsomest posts that were ever produced or installed for that purpose.

To attract attention to and to bring out the full beauty of the posts, they have been painted a flat white, and as a result they appear as if built of pure alabaster, presenting a striking appearance, both during the day time and at night, but especially at night when the lamps are lighted and the 14 alabaster ball globes glow like balls of fire, producing a brilliant illumination and a harmonious effect which instantly attracts the admiration of every passer-by. The light is so bright that a newspaper can easily be read at the walls of the building across the streets.

The base of the post up to the beginning of the fluted shaft, in addition to the flat white paint, has been given several coats of a special outdoor enamel. This permits the base of the post to be washed off each morning by the night watchman, so that it always looks clean. If any serious dirt spots appear on the shafts of the posts they can be removed with Bon Ami or similar compound, and, of course, it is the intention occasionally to give the entire post an occasional coat of white paint. It has therefore been found that it is entirely practical to have the posts painted white, even in a comparatively dirty location.

The gas company had several objects in view in making this installation—the adornment of its own location, as this installation is to be permanent; the stimula-

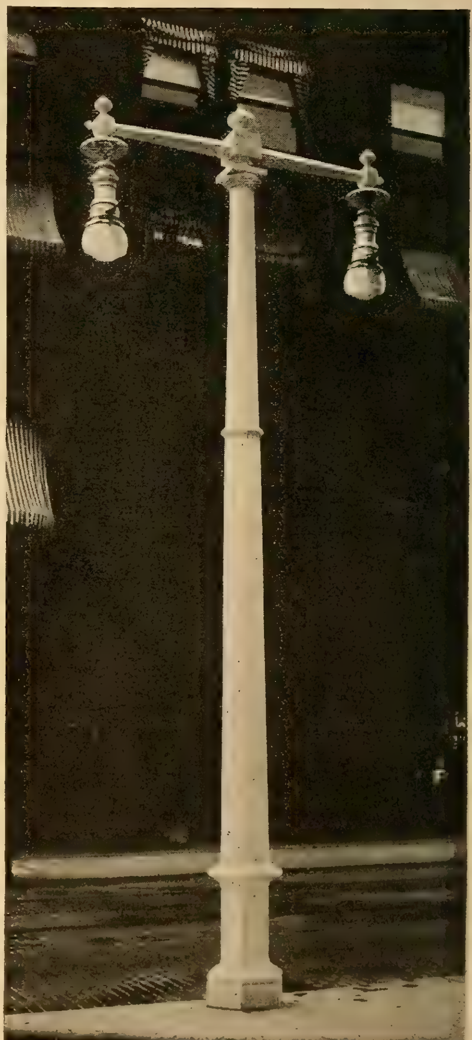


FIG. 1.—TYPE OF ORNAMENTAL STANDARD USED IN GRAND RAPIDS, MICH.

FIG. 2.—NIGHT VIEW, SHOWING EFFECT OF ILLUMINATION.

tion of civic pride, leading toward the beautification and better lighting of the business district; and the giving of an object lesson to show what can be accomplished in the way of street lighting by up-to-date gas lamps, "the great white lights," which not only are ornamental but which give a splendid illumination.

FIG. 3.—DAY VIEW, SHOWING ORNAMENTAL EFFECT OF POSTS.

Railway Car Illumination

By L. Schepmoes

Specializing is the active principle in modern business. The great industries of our country have resulted from concentration of thought and energy in one particular line of manufacture. The large men of affairs have framed their careers within a confined line of action. The man who knows and is liberally paid for what he knows is the specialist. The manufacturer who succeeds does so because he knows the conditions governing the use of his product, because he specializes in his search for experience, because he specializes in making his experience a commercial asset.

The illuminating engineer is a specialist. The subject of artificial illumination was indifferently considered by the designers and manufacturers until recently, because they had other irons in the fire. It required the undivided efforts and concentration of a few men to infuse system into this chaos. These men are illuminating engineers. These men are specialists.

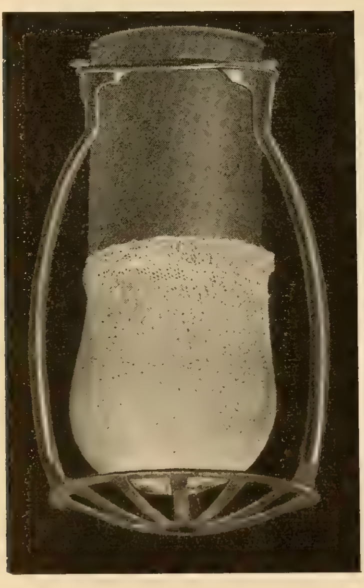


FIG. 1.—THE PINTSCH GAS MANTLE, SHOWING METHOD OF SUSPENSION.

Railway train lighting has many problems common to illuminating engineering as a whole, but also presents many features not common to the broad field of illuminating engineering. The compulsory adherence to established practice in car building, the bad proportions of car interiors, the fixed position of the furniture or car seats, and the severe service are all conditions that require special study. The novice in this branch of illuminating engineering is sure to meet discouraging conditions. The conditions are there. They can't be changed. They seem to say, "Take what you find and make the most of it." Therefore car lighting is a specialty of illuminating engineering. In spite of these conditions, or perhaps because of them, railway car illumination can claim the most consistent adherence to the science of illuminating engineering. To-day we cannot afford to ignore the progress manifest in scientific illumination of railway cars.

Aside from the fundamental principle of obtaining good illumination with proper light sources of sufficiently high candle power and the distribution of the light by suitable reflectors and shades, the design and construction of the lighting fixtures is of vital importance in train lighting. The mechanical construction must anticipate the severe service and provide strength, compactness and ease of manipulation to meet these requirements. No doubt, many of the mechanical and illuminating features incorporated in car lighting fixtures would not warrant a consideration by the designer and manufacturer of house lighting fixtures. We might suggest, however, that a casual study of some car lighting specialties would not be amiss; if for no other purpose than to demonstrate what experience, concentrated thought, conscientious effort and science can accomplish when devoted to a special field of industry.

For gas lighting, the Pintsch inverted mantle is now almost exclusively used on modern equipment. The construction of

FIG. 2.—SINGLE LAMP UNIT ELECTRIC FIXTURE.

this mantle is such as to insure a long life in service. A careful record of twenty-six cars on one road for a period of one year, based on actual service, shows an average life for these mantles of 233 days. Assuming a conservative average of three burning hours per day, it will be seen these mantles give approximately 800 burning hours' service. The ingenious method of applying and supporting these mantles is shown in the accompanying illustrations. It will also be noted that the gas is screened from any dirt or dust, that the flue areas, the air chambers, the burners and the gas supply of the fixtures are all paramount and carefully related to the production of a high candle-power light source, with the consumption of the least amount of gas. Each mantle gives 100 c.-p. light and consumes 2.12 cu. ft. of gas per hour at a cost of about 1 cent an hour.

The distribution of light in these mantle lamps is effected by a globe combining an efficient reflector and diffusing shade in one piece of glass. These globes are worthy of more than casual notice. The upper portion of the bowl is opal plated; this gives an ideal reflecting surface and is easily cleaned. The dust and dirt in railway cars are important factors to be considered and this fact is well guarded against in the use of these shades. The lower portion of the bowl is optically ribbed to produce a diffusion of the glare from the intense brilliancy of the mantle, but does not absorb any great amount of light. The avoidance of glare in railway cars is the most difficult problem met with by the illuminating engineer. The lamps must necessarily be hung low and the fixed position of the passenger in the car seat makes the problem a hard one to solve. These shades or globes seem to have provided a satisfactory solution, however, and on account of their pleasing lines and adaptability to design could well be emulated in other fields of illumination. The use of these globes is not confined to gas lamps, but is successfully incorporated in many electric fixtures for car lighting.

The method of supporting the shades or reflectors on both gas and electric fixtures is probably the most interesting and practical mechanical feature we have ever seen. The vibration of the train, the necessity for quick removal or replacement of shades at railway terminals or by car cleaners, the danger of using any screws, springs or other loose members, and the flexibility required in car service are ingeniously provided for in this holder. Any type of glass or metal shade adapted for the commercial line of

FIG. 3.—GAS OR ELECTRIC FIXTURE, USING SPECIAL DIFFUSING SHADE.

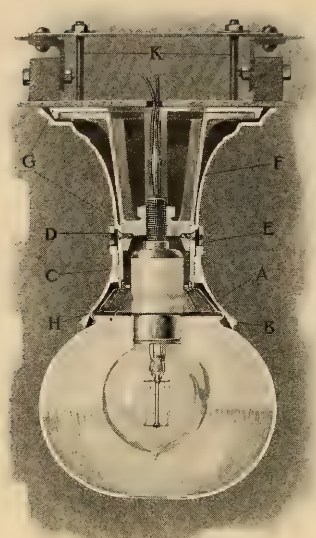


FIG. 4.—ELECTRIC LAMP, USING SPECIAL GLOBE.

holder can be used. The principle of this holder is simply a spring clamp having a plurality of tongues, which grip the neck of the glass, and a lock-nut which acts as an extra precaution against the glass dropping out of the holder. To insert the glass, all that is necessary is to expand the spring clamp by inserting the neck of the glass until it snaps over the lip when the lock-nut is turned down on this clamp. There are no screws or springs to lose or break, expansion and contraction of the glass is taken up and strength and compactness necessary in car service insured.

With modern car lighting fixtures and improved diffusing glassware it is impossible for the observer to tell whether gas or electricity is being used to supply the light. This is in accordance with the fundamental principle in illuminating engineering that the original source of light should be entirely hidden.

Fig. 3 shows a fixture which is made to receive either a tungsten or tantalum lamp or a Pintsch inverted gas mantle according to the preference of the railway management.

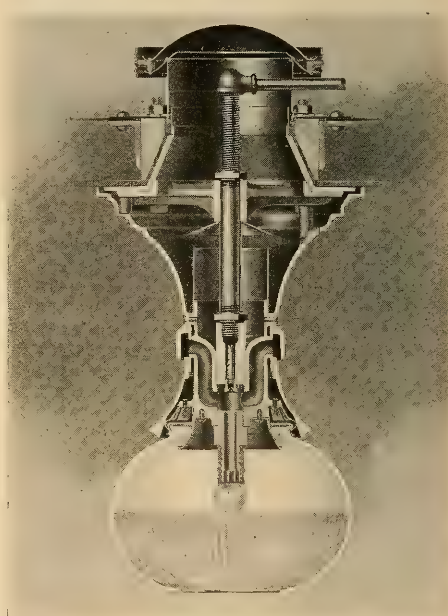


FIG. 5.—PINTSCH GAS MANTLE LAMP, SHOWING CAREFUL ARRANGEMENT OF PARTS TO OBTAIN BEST ILLUMINATION.

Notes On Comparison of Illuminants

By R. F. Pierce.

A prominent feature of recent contribution on the comparison of illuminants has been the tendency to introduce, and apply to gas lamps only, certain factors supposed to represent the discrepancy between laboratory performances and the results obtained in actual practice.

While the contributors have appeared to be very much satisfied as to the validity of their conclusions and the fairness of their comparisons from which they were obtained, these comparisons were drawn from such radically different sources and such insufficient data, that the subject merits more extended discussion than it has heretofore received.

The obvious unfairness of assigning, as a depreciation co-efficient, a factor ob-

tained by comparing the performance of a gas lamp under certain standard conditions with that of a number of lamps under widely varying conditions, and equipped with mantles of all sources and conditions, is at once apparent. It is exactly similar to the comparison of the laboratory performance of a tungsten lamp of first-class quality at its rated voltage with an average obtained from commercial installations of lamps ranging in quality from the poorest to the best, and operated on circuits in which the voltages range from say 10 per cent. below the normal voltage of the lamp up to normal.

The variables which influence the performance of an incandescent gas lamp are as follows:

First—Construction of the burner.
Second—Quality of the mantle.
Third—Adjustment of the burner.
Fourth—Quality of the gas.
Fifth—Gas pressure.

For the purpose of comparison with other illuminants, the first and second variables may be eliminated as corresponding to the difference in quality and efficiency of the various grades of electric lamps. As both the gas and the electric lamp manufacturer is entitled to the judgment of his product by the best quality of apparatus commercially available, the restriction of comparisons to those referring only to the highest quality of commercial lamps and mantles is entirely just. Whether or not the customer decides to avail himself of the best or to be content with the poorest is obviously outside the scope of comparison.

It follows, therefore, that no comparison between gas and electric lamps is of the slightest value, unless it is distinctly understood and clearly shown that only lamps and mantles of the best grade enter into the comparison.

As far as evaluating a factor for correcting from laboratory to service conditions, the effect of gas pressure may also be eliminated as corresponding to voltage fluctuations and variations on electric circuits, producing discrepancies between the performance of electric lamps at normal voltage and the voltages at which they may be operated, which is found as frequently on electric circuits as varying gas pressures of like effect are found in commercial gas service. It also follows that unless the gas pressure is clearly shown to be practically identical with the rated pressure, it is unfair to make any comparison with electric lamps burning at rated voltage. It has been alleged that the increased efficiency of the tungsten lamp at over-voltage as against the decreased efficiency of the gas lamp with over-pressure, may be regarded as offsetting the decreased efficiency of the electric lamp on under-voltage. This allowance is by no means fair, as the subjection of a tungsten lamp to over-voltage results in a rapid reduction of the burning life, while the gas mantle is not injured in the least by any excess in pressure that could be encountered in practice.

The adjustment of the burner permitted with gas lamps and the absence of such adjustment in electric incandescent lamps are purely commercial considerations, and the superiority may lie with one or the other, depending upon circumstances. Comparing gas and electric service in which the pressure and voltage remains constant at any one point and wide differences are found at different points, due to pressure and voltage drop, the adjustability of the gas lamp is a feature of considerable superiority.

If the regulation of main pressure and line voltage is poor, the adjustability of the gas burner will be advantageous, provided the ranges of voltage and pressure are such as to produce like effects upon the candle-power of the lamp, as the user is supplied with means for maintaining his illumination at a satisfactory level, whereas, with electric incandescent lamps such adjustment is impossible. In comparing results upon a gas service of poor regulation with that upon an electric service of good regulation, of course, the advantage is with the electric lamp, but this is a matter of service, not of lamp performance, and has no legitimate place in the comparison of the illuminants.

As regards the question of gas quality, this is also a matter of service, only. It goes without saying that better results will be obtained upon a well operated electric service than upon a carelessly maintained gas service. This again has no bearing upon the comparison of the illuminants, as there is no excuse in varia-

tions in gas quality of such an extent as to effect the performance of lamps to any considerable degree.

The alleged effects of temperature and humidity upon the performance of gas lamps may be disregarded in the absence of any evidence that considerable fluctuations in candle-power may be thus accounted for in actual practice.

Altogether, it is obviously and flagrantly unfair to consider the effect of controllable factors having to do with the quality of the service only, as entering into a comparison of illuminants. That these controllable factors are of considerable importance in accounting for the discrepancies between laboratory and service performance of gas lamps, will be evident from a consideration of the source from which some of the recently published data on this subject has been obtained.

It will also appear that it is preposterous to evaluate from a comparison between laboratory and service performance a factor presenting depreciation in service, unless all controllable factors are stated, and in practically no case, has this been done.

In a recent contribution upon this subject (report of Committee on Competitive Illuminants, N. E. L. A., May, 1911), the following quotation from a statement made by Mr. Preston S. Millar, appears:

"The real discussion of the question (of the efficiency of gas lamps) has hardly been undertaken, because nothing has been said except about the initial value. The average efficiency throughout the 1,000-hour tests ran something like 80 per cent.; that being the case, it is hardly fair to present figures of light flux and consumption without stating that they represent initial value. There is a considerable change indicated in efficiency, as shown by the tables which have been presented. Take, for instance, from 2 inches to 3 inches pressure; the change in efficiency is something like 12 per cent. That seems to be very small compared with some lamps I have seen. The curve of efficiency is frequently a peaked curve with a rather narrow peak. To get the best efficiency requires very careful adjustment. Only last week I came across an instance in which a gentleman of very large experience in lighting matters, whose work is accepted as authoritative in many instances, made a laboratory test on some lamps and got an efficiency figure of about 30 per cent.; it was a case of poor adjustment. The average householder does not make a good adjustment of his lamps; hence, the laboratory figures in the case of gas lamps must be received with much caution. I have had that borne in upon my mind strongly of late. In street lighting with incandescent lamps, where the lamps are maintained by the company which is particularly interested in their performance, we might expect to find the best practical adjustment. My experience is that the average candle-power street lamps is about 60 to 70 per cent. of the rated candle-power, as shown by the long laboratory test. It shows what we must take from the laboratory efficiency of the gas lamp."

As regards the failure of a gentleman of experience in lighting matters to make an adjustment obtaining within 70 per cent. of the rated efficiency, it is impossible to say much without more information as to conditions. In case the lamp was designed for operation on an entirely different kind of gas, such a discrepancy might well occur. This is fairly comparable to the performance of a 125-volt tungsten lamp on a 104-volt circuit.

It is safe to say that the average householder is able easily to adjust, within 15 per cent of rated efficiency, any gas lamp burner properly designed for the kind of gas used.

During a test of gas lamps occupying over six weeks, all adjustments were made by inexperienced persons by the eye alone, and without more care than the average consumer would take. The results averaged about 15 per cent. below those obtained by photometric adjustment. In another test a *skilled* adjuster was able to come within 5 per cent of the photometric adjustment.

It should be understood that a properly selected gas lamp requires but one adjustment—that of the needle valve—and that is obtained by opening the valve until increasing incandescence ceases, then shutting off to a point immediately above the appearance of decrease. The entire adjustment thus depends entirely upon the power of the eye to distinguish increments of illumination, and an eye unable to distinguish a variation of 15 per cent. would certainly be abnormal.

In reference to the low average candle-power of street lamps in connection with the statement that the lamps are maintained by the company which is particularly interested in their performances, it is by no means convincing as bearing upon

the unavoidable depreciation of the lamps in practice. Unfortunately, many street lighting contracts are obtained upon such a basis that the interest of the company lies principally in decreasing maintenance costs, and has little to do with the good performance of the installation. A particular instance of the uselessness of such conclusions will appear later.

In the same contribution, reference was made to the report of the Merriam Commission of Chicago, who investigated nearly 1,000 gasoline street lighting lamps, in which only 60 per cent. were reported as "passable," and the average candle-power was found to be but 41 per cent. of the rated value of 60 candle-power, which was supposed to represent the initial performance of the lamp.

In commenting upon another reference to the report of this Commission, Mr. J. R. Cravath, under whose supervision the tests were made, says:

"Since the Merriam Commission investigations were made, a new contract has been enforced which provides for rebates through the city, when 150 lamps were tested per month, averaging below 45 candle-power, the test being made with the glass lantern door open, instead of closed, as on the Merriam Commission test. As a result of this contract, maintenance conditions of gasoline lamps have been so improved that I am now informed the candle-powers average in the neighborhood of 60 with the lantern door open." Trans. I. E. S., June, 1911, p. 557.)

Inasmuch as after the report of this commission, the performance of the lamps averages in the neighborhood of 100 per cent. of the rated or initial candle-power, it is perfectly evident that the discrepancy of 59 per cent., referred to above, was due not to depreciation of mantles or lamps, as alleged, but to controllable factors having to do entirely with the service of the contracting company. From this same consideration, it is quite evident that it is by no means safe to assume that lamps operated by a contracting company are always maintained at maximum efficiency by reason of the supposed interest of the company in so doing.

In the same contribution referred to, there appears the following reference:

"In the Transactions of the I. E. S., for November, 1909, page 789, Mr. Norman Macbeth, of the Welsbach Company, published laboratory tests showing the amount of useful light, as determined by the number of lumens effective on the working plane, which could be obtained from Reflex units equipped with both Holophane reflectors and diffusing globes under laboratory conditions. The results of these tests are given in Table No. 2-A, in direct comparison with the rated values. It will be noted that the values obtained in the laboratory were almost exactly those which he calculated would be obtained in practice.

Illuminometer Tests of Gas Installations.

Equipment	Area sq. ft.	Intensity ft.-cds.	Useful Flux Lumens.	Number of Burners	Effective Lumens per lamp Actual	Effective Lumens per lamp Rated.	Per Cent. of Rating.
2(A)							
Reflex-Holophane ...	1055	7.377	7770	24	324	330	08.0
Reflex-Sandblasted ..	1055	5.35	5640	24	235	231	102.0
Reflex-Sandblasted ..	1055	7.21	7610	24	317	316	100.0
2(B)							
Reflex-Holophane ...	685.5	4.25	2915	12	243	363	67.0
Reflex-Sandblasted ..	1350	2.6	2510	16	219	275	79.6
Reflex-Holophane ...	2575	2.5	6450	18	230	363	63.4

"Mr. Macbeth has also published data (see Amer. Gas Light Journal, October 11, 1909, page 860, and Proceedings of the Amer. Gas Institute, 1909, page 299) on actual installations of gas lamps designed and tested under his direction. The results of these tests are shown in Table No. 2-B. It should be noted that the average value obtained in these three tests was 70 per cent. of the rating. It seems fair to assume that the lamps were operating under the best service conditions."

The results of these two tests are so tabulated as to carry the impression that the discrepancy between the results obtained represents the difference which may be anticipated between the performance of gas lamps in the laboratory and in actual service. The validity of this conclusion is seriously impaired by the fact that in the reports of tests on actual service, no figures were given for gas pressure, nor was it stated whether the gas was coal gas or water gas.

The obvious unfairness of referring to the figures in Table 2-B as representing

the operation of gas lamps under the best service conditions is convincingly set forth in a criticism by Mr. Macbeth, of a similar attempt in the Trans. I. E. S., June, 1911, page 536:

"I can say positively that on that work no adjustments of lamps were made, and no attempt was made to get special installations. On the installations reported here, I had no rights other than those of a man on the street. We simply went into the various locations in different cities, choosing a time when people in the store were not busy."

He states that the object of these tests was the evaluation of a "utilization" factor, to take into consideration "average conditions of maintenance, average glassware conditions, and not always good gas conditions."

Mr. R. C. Ware, commenting upon the same comparison, says (I. E. S., June, 1911, p. 567):

"Mr. Macbeth gave in the paper referred to a purely general description of the installations referred to, which treated only vaguely the actual layout. The color scheme is not described particularly, but from the few words given, it is apparent that it was such as to be fairly high in light absorption. The number and size of windows in proportion to wall space is not given; the number of projections and pillars, if any, which should cause shadows and interference with general illumination; and the number of empty shelves and the color of shelving, which together would play an important part in the absorption of light, are not given."

It is perfectly plain that, far from being intended to represent good service conditions, these tests were made for the evaluation of a factor by the application of which to calculations with lamps under standard conditions (25/10″ pressure of water gas) results might be obtained that would yield satisfactory results on services of unknown gas quality and pressure. As these figures were to be utilized in actual design of lighting systems, generally made without reliable information regarding gas conditions, it is fair to believe that they are ultra-conservative. They are not, nor are they intended to be expressive of the actual performance of gas lamps under average conditions, but include a "factor of safety" which, in view of the author's reputation for conservatism, may be fairly assumed to be large.

It should also be noted that the laboratory tests were conducted in a large room with 24 lamps, whereas, a number of the service tests were taken in smaller rooms, containing but 4 or 5 units. This fact, alone, would probably account for a difference in illumination of 10 per cent.

It is also of great importance to note the absence of figures for gas consumption. In cases of reduced candle-power, due either to mantle shrinkage or low pressure, gas consumption also decreases, and figures for candle-power depreciation, or rather discrepancy, do not represent discrepancies of like amount in efficiency. The absence of gas consumption data vitiates the entire comparison for any other purpose than determining the number of lamps required for certain results, and this of course is the purpose which the author had in mind when the tests were made.

In the same contribution, reference was made to a test made by Messrs. Lansingh and Rowe, of the Holophane Company, on a display installation at the offices of the Consolidated Gas Co. in New York:

"In the Transactions of the I. E. S. for January, 1910, page 19, Messrs. Lansingh and Rowe, of the Holophane Company, published illuminometer tests made on a display installation at the offices of the Consolidated Gas Company in New York. The results of their tests are given in Table No. 2-C. The average value obtained was about 81 per cent. of the rated. This installation was designed by Mr. Lansingh, and it is again fair to assume that the lamps were in the best condition, since in these offices all mantles are changed once a month, whether they show any signs of depreciation or not.

"At the 1910 Convention of the American Gas Institute, the engineers of the Consolidated Gas Company reported the results of illuminometer tests made six months later on the same installations tested by Mr. Lansingh. The results of their tests are given in Table No. 2-D. The figures obtained by these engineers were 30 per cent. lower than those published by Mr. Lansingh. and the average was but 56 per cent. of the rated value. Tests by the Engineering Department of the National Electric Lamp Association and many other authorities check fairly well with this figure, which represents, approximately, what the average consumer under a maintenance contract is obtaining from his lamps." (Table top of page 429.)

No mention, however, was made of the fact that the lamps in these tests were operated upon gas at 1½″ pressure, and this variation from the gas pressure under

TABLE 2— (C AND D).

Equipment	Area sq. ft.	Intensity ft.-cds.	Useful Flux Lumens.	Number of Burners	Effective Lumens per lamp Actual	Effective Lumens per lamp Rated.	Per Cent. of Rating.
2(C)							
Reflex-Holophane ...	1745	4.64	8090	28	289	363	79.6
Reflex-Holophane ...	1680	4.57	7680	26	295	363	81.4
Reflex-Sandblasted ..	1680	5.65	9500	36	264	316	83.5
2(D)							
Reflex-Holophane ...	1745	3.48	6060	28	217	363	59.8
Reflex-Holophane ...	1680	2.536	4250	26	164	363	45.2
Reflex-Sandblasted ..	1680	4.294	7210	36	200	316	63.3

which the laboratory tests were made, would nearly account for the entire discrepancy in the first test. In none of the tests referred to was any data submitted regarding the quality of mantles with which the lamps were equipped.

The assertion that these figures represent what the average consumer of gas is getting in the way of service, is absolutely unwarranted until it is shown that the average gas conditions and mantle qualities are identical with those represented by these tests. This not only has not been done, but the tests are so few in number that, for the purpose of averaging, they are practically useless. It is safe to say that the average performance of gas lamps is considerably above the figures shown, as the average pressure is much higher, and constantly being increased.

It is one thing to use an average as representing a mean between good and poor gas conditions for the evaluation of a reduction factor which may be applied for the purpose of insuring that calculations from given standard conditions shall secure satisfactory results under *any* commercial conditions. It is entirely another thing to take the same average as representative of the service which the average user may expect. It is not only quite possible, but extremely probable that the average gas conditions taken from all the plants in the country would be greatly above the mean of the best and the poorest.

Comparisons which do not recognize this fact are not comparisons at all.

It is quite evident that the data submitted by Mr. Macbeth was intended to represent the former, rather than the latter, and that its use for the latter purpose is highly misleading as to the actual state of affairs.

The Lighting of the New Hotel Sherman, Chicago

The last two years have witnessed a successful effort to rehabilitate the hotel accommodations of Chicago. Like many other American cities, the metropolis of the West suddenly found that its hotels had fallen behind in the general rapid progress, and it forthwith started out in good earnest to bring them up to modern standards. Among the number of magnificent new establishments is the Hotel Sherman.

In the interior architecture and decoration there is a plainly expressed intention of producing an effect at once magnificent and gorgeous. The success with which this has been accomplished is well shown in the view of the lobby on the front cover panel. The architectural treatment is massive and the decoration elaborate, following in general the motives of the Louis XV. period. This has been consistently carried out in the design of the lighting fixtures. A unique feature of these is the combination of the candle effect with the distinctly electrical element of pendant incandescent lamps. The chandeliers are treated as important parts of the decoration and furnishing, as well as sources of illumination. Particular note should be made of the handsome lamp standards on the fixed settee, which furnish an ideal light for reading, coming from the rear in any position which the reader takes.

Fig. 1 is a section of the main dining room. The same magnificence of architectural and decorative effect is evident

Photos by Chicago Arch. Photo Co.

FIG. I.—A SECTION OF THE MAIN DINING ROOM OF THE NEW HOTEL SHERMAN, CHICAGO.

here, and the same consistent harmony in the design of the lighting fixtures with their surroundings. Massive and elaborately carved lanterns serve to furnish general illumination, particularly for the ceiling and upper side walls, while brackets supply more direct illumination to the tables. The magnificence of the latter is accentuated by their double support. The idea has plainly been to produce an effect of the greatest brilliancy and sparkle without giving actual offense to the eye. The prism decorations of the brackets carry this out very successfully.

Fig. 3 is one of the corridors in which handsome oak paneling constitutes the decorative treatment. As the ceiling is low, handsome plaques are used for the general illumination, with candle brackets as auxiliaries.

Fig. 4 shows the buffet. The illumination here is by ceiling bowls and brackets, the lamps in both cases being thoroughly diffused by the glassware.

The features shown constitute only a small portion of the various types of fixtures used. As a whole the lighting is an excellent example of what may be termed the architectural treatment of illumination—*i. e.,* the lighting has been considered as a part of the interior decoration, and while sufficient illumination has been provided in each case, the fixtures are prominent parts of the furnishings.

Photos by Chicago Arch. Photo Co.

FIG. 2.—A CORRIDOR.

Photos by Chicago Arch. Photo Co.

FIG. 3.—THE BUFFET.

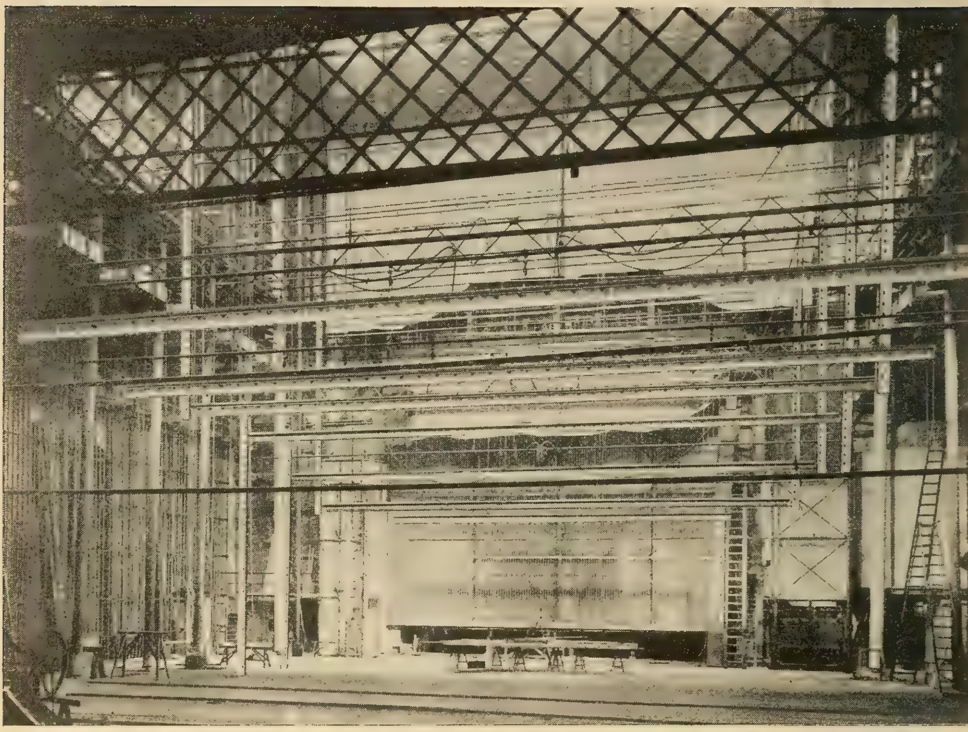


FIG. I.—THE STAGE IN PROCESS OF ERECTION. NOTE THE BORDER LIGHTS.

Lighting of the Stage of the Berlin Grand Opera House

By Dr. Robert Grimshaw.

The requirements in respect of safety, intensity, variety and adaptability of illumination in modern theaters have made giant strides in the last ten years; and it is difficult to say whether the managers have spurred the inventors and manufacturers of illuminating and controlling appliances, or the latter have taken the initiative and impressed upon the former the desirability—even the necessity—of improvement. The local boards of fire inspection, or their equivalent, have also had their say; and in some instances this has been put rather plainly—indeed, taken the form of what Germans call "a hint with a fence-paling."

A good example of modern methods in theatrical illumination is offered by the Royal Opera House in Berlin—an institution all the deficit of which—a good round sum—is paid by His Majesty Kaiser Wilhelm in his capacity of King of Prussia.

Incidentally it may be remarked that there are on the Berlin stage many lights which are of American origin—in the shape of the leading artists. Indeed, the Kaiser is credited with saying that the only thing wanting to make his Opera House completely American was an American prompter.

But to get back to the question of the special features of the illumination in this building, especially on the stage, and how they are produced.

It was seen last summer that the dan-

ger of fire was too great, by reason of the large amount of wood used in the upper portions of the stage edifice; and while rebuilding was necessary, the lighting facilities were also brought up to date from the point of view of security from fire.

Experiments which had been made since 1882 with the so-called "three-lamp system" of Brandt having shown the worth of this method of lighting, there was introduced in 1888 by the Allgemeine Elektrizitäts-Gesellschaft a further extension of this system; and it is this which is now carried out in wonderful completeness by the same establishment, to the courtesy of which we are indebted for the photographs here reproduced.

It is not long since that theatrical managers, as well as the audience, were satisfied with a rather crude jump from white light to either red or green, as would seem appropriate or not; but nowadays there are demanded all sorts of tender tones and delicate shades to represent Nature as nearly as possible.

The first step towards the attainment of this ideal was the addition of a fourth lamp color—yellow—which is sometimes replaced or supplemented by light blue.

The new lighting plant in the Berlin

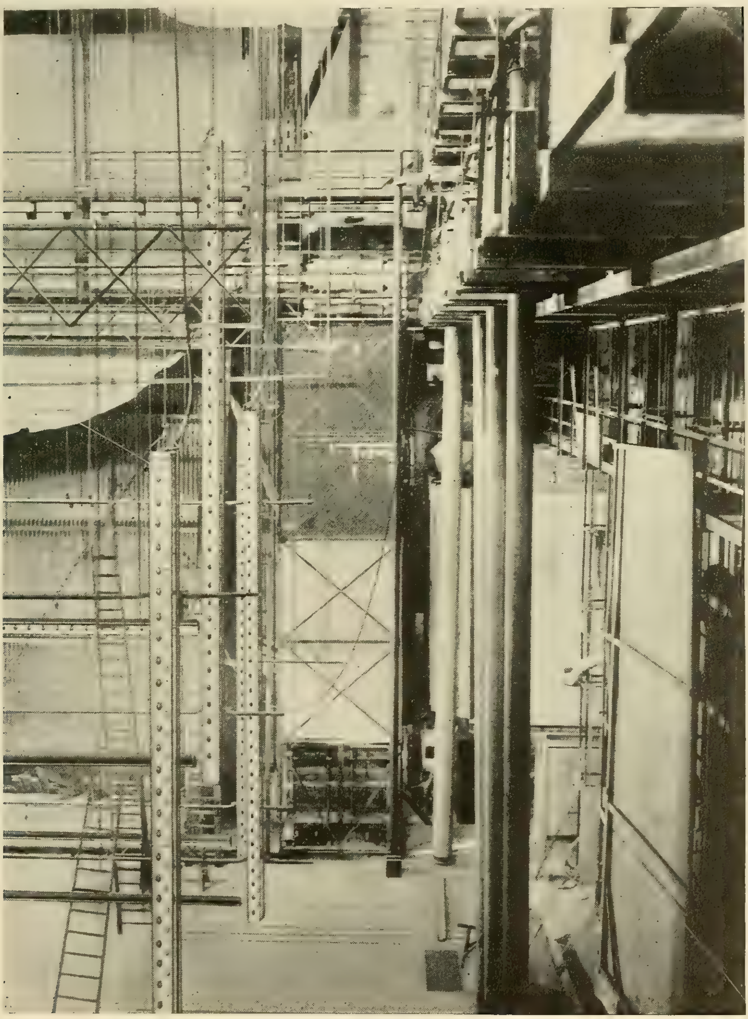


FIG. 2.—THE SIDE LIGHTS.

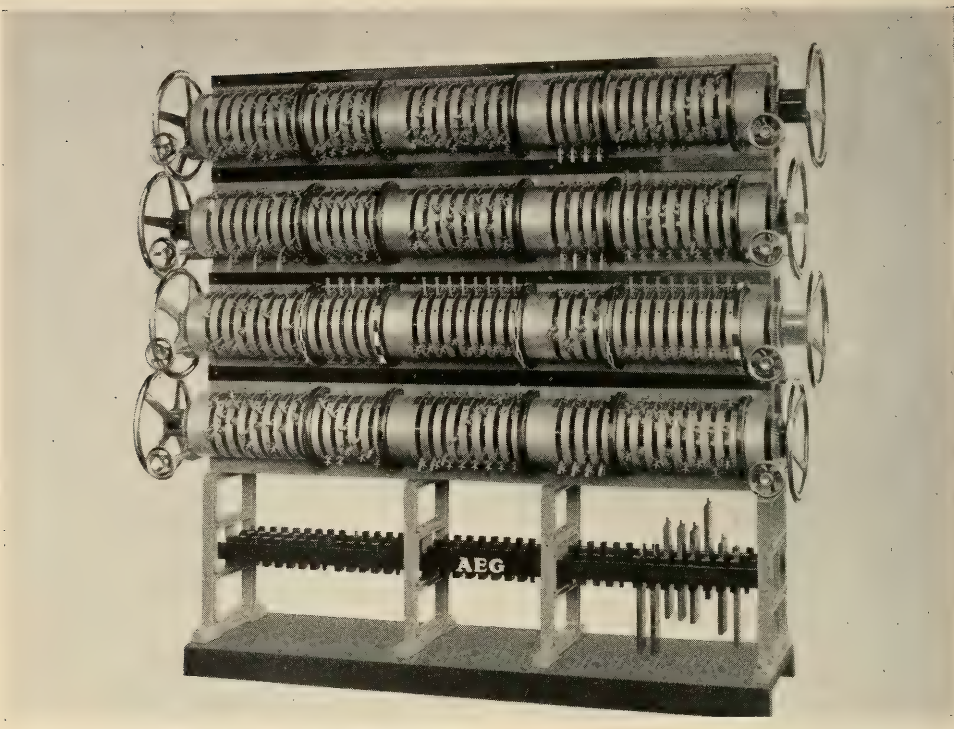


FIG. 3.—THE CONTROLLER.

house is about 40 per cent. stronger than before considered necessary. This increase in brilliancy is rendered possible by the use of metal filaments. As the incandescent lamps with these filaments use only one watt per candle, as against the formerly required three, this increased lighting effect has been attained without much greater cost. Just how extensive the present plant is, may be judged from the fact that for the stage alone there are 3000 incandescent lamps of 50 standard candles each; served by 26 miles of conductor, in nearly 17 miles of insulating tube. The lamps are arranged in sections of 93 feet each; and in addition to the conductors just cited there are 3280 feet, or about five-eighths of a mile, of flexible "stage cable," and about 150 "outlets."

Great stress has been laid on great simplicity, despite the necessity of producing a fine artistic effect, and the immense size of the stage; and here long experience has been of prime value.

Fig. 1 shows the stage in process of erection. Here one sees that more than ever the stage is free from the use of portable side screen lighting. Formerly this was attained by stands about 10 to 12 feet high, borne on carriages running in the stage grooves, and of about the same height as the stands. The current was delivered by cables, carried under the stage on rollers, and which were of course exposed to dampness and mechanical injury. The insufficient height of the lamps from the floor caused badly distributed illumination—the under parts of the scenery getting too much light, and the upper parts too little. There were very often, in fact, dark spots in the upper portions; in certain parts of the stage the players were exposed to an undue brilliancy, and their shadows were cast strongly on the scenery. Further, these side-lights took up much room that would very gladly have been used for something else.

The present side-lights, which are at a height of about 22 feet from the stage floor, correspond rather well to the horizontal soffit lamps, and light up fully the side scenes, as may be seen in Fig. 2.

They hang on cables and are carefully counterbalanced by weights, so that they are readily moved up and down, and thus can give all the requisite delicacy and variety of effect.

They are usually lowered to about the height of the performers' heads, so that a natural illumination is produced, and no shadows thrown. The cables are run above in the manner just mentioned. For "panoramic effects" these lights may be suddenly raised clear of the stage, so that the latter remains free, but for all that the illumination comes properly from above. The easy and rapid withdrawal of these lighting groups is of great advantage in rapid scene-changing.

A very thorough subdivision of the upper and lower lights, and of the footlights, permits illuminating certain portions of the stage to the exclusion of any other, or of all the rest, or the use of light of different colors in different portions thereof. For illuminating the transparent scenes from behind there is a soffit subdivided very minutely in width and height, permitting the local application of light to the transparent portions of the background at will.

The management of the lighting arrangements requires a central station which shall not only enable switching the lights in and out, but also permit a very fine graduation of the intensity of the illumination. The regulating apparatus which effects this in a most thorough manner, and is shown in Fig. 3, is like a musical instrument with a very extensive keyboard. There are 132 different levers, each of which may be placed in any one of 100 different positions; so that the attainment of a high degree of variety and refinement in stage-lighting is rendered possible.

The illumination may be altered by varying the color of the light, or its intensity, and by combinations. The switchboard that effects the desired changes and combinations is the most complete ever made for this purpose in a theater; but for all that, its dimensions are not formidable, and it may be served by a single employee, who has good opportunity to observe the illumination of the entire stage.

FIG. 4.—THE ILLUMINATION OF ONE OF THE SCENES OF "DIE MEISTERSINGER."

Corresponding to the four sets of lamps of as many different colors, there are four rows of levers, arranged one above the other, as shown in Fig. 3. Each lever moves, by means of a wire connection, the slide of a regulating resistance, and throws this gradually out of circuit, so that the current in the lamps rises, and their intensity increases. For each of the 33 levers for each color there is an arrangement by means of which they may all be either brought into contact or thrown out, by throwing it slightly by turning a shaft carrying hand wheels (shown at the sides). Each group of levers for lighting appliances of a similar kind can be manipulated independently of any or all of the others.

Every regulator lever moves along a scale, and thus it is possible to reproduce any desired effect. For the first time it has been possible to read every part of all the scales simultaneously. A very practical improvement enables the cutting out of each lever at any point along the scale, automatically, so as not to go beyond the predetermined degree of intensity.

There is also provision for determining beforehand the brilliancy with which the illumination shall commence.

There have been introduced on the stage a number of novelties in other lines of stage illumination. The Fortuny system, by means of which the lighting of the stage can be so well effected by regulatable arc lamps, could not here be introduced, as the rebuilding had to be done with regard to the old limits of space; but it is intended to use it in part.

Fig. 4 shows the illumination of one of the scenes in the " Meistersinger."

The Ultimate Relation of Illuminating Engineering to Public Utility Corporations—An Analysis

By F. Laurent Godinez.

II. (Concluded) Internal Conditions Limiting Public Relation Policy.

The representative of an illuminating company's new business department is, from the viewpoint of the manufacturer's salesman, an *unknown* quantity. This is due to the fact that while the representative is engaged in the sale of *energy,* the salesman is engaged in the sale of *energy consuming* devices. The responsibility of the former, both to his employer and his client, is greater than the latter. The salesman of lighting accessories knows his orders must cover his salary and traveling expenses by a wide margin. The representative knows that the duration of his occupation depends on his ability to obtain new consumers, or in persuading a more *extensive* use of service by the present consumers. The distinction is that the representative is continually in touch with the consumer, while the salesman is not. This means that when a manufacturer's product fails in any way to please it is the representative who must stand the brunt of all adverse criticism from the consumer.

The manufacturer is very often lacking in the knowledge of what is required; in this he is not to blame, for in many cases central stations in the smaller cities have but a slight conception of their own needs, and no realization of future requirements. The recent rapid development in artificial illuminants has been largely responsible for this condition, and it would appear that the pace has been too rapid for the manufacturer of lighting accessories to cope with.

While unquestionably the sincere and earnest work of the physicist has raised the technical standard of illuminating engineering to the highest plane, it is to be regretted that this work as a whole is not intelligible to the average central station representative. Even the data furnished by the manufacturers of lighting accessories would be of much greater value if presented in simple form, intelligible to a non-technical graduate.

This condition resulting from rapid development has been productive of many

unsatisfactory issues. The consumer, for example, has come to look upon illuminating engineering with considerable disfavor, because he has never been introduced to the genuine article. He has grown to believe that the title "illuminating engineer" is but a commercial appellation. It is well to remember that the success of any book, play, or in fact, any big movement influencing the welfare of humanity, has never yet depended on the trenchant pen of the critic, but on the public, who are the final judges, and from whose decision there is no appeal.

The public and the public utility are inseparable, as has been shown; hence the veering of public sentiment in the wrong direction may properly be regarded as a danger signal by all concerned.

If the engineering societies devoted to the interests of the art and science of illumination would issue standardization reports, and rules for conducting tests of competitive illuminants and accessories the consumer would feel that he had at least a staff to lean upon. Such a measure could not fail to result in a universal appreciation and respect for a society which up to the present has been unknown to the general public.

Of course, any one can understand that no manufacturer of standing will allow members of his sales force to make misrepresentations. Similarily, no salesman of character will make such misrepresentations, provided he is familiar with the subject of artificial illumination. But here again we are confronted with the fact that while the average salesman is familiar with the particular product which he is selling, he is quite unfamiliar with his competitor's product. Unfamiliarity and ignorance being synonymous in this sense, he quite often makes statements in good faith which are unjust and untrue. When the consumer discovers this, as he always does eventually, illuminating engineering drops several degrees in his estimation. The writer believes that the above general criticism is essentially fair and quite true with respect to present conditions. No one is to blame. The rapid development of the subject is alone responsible.

There is a vital issue to be faced however, and one which involves not one, but many phases. The manufacturer of illuminants, the manufacturer of reflectors, the public utility engineers and representatives all have different conditions which must in some manner become reconciled, and this can only be accomplished by sincere co-operative effort. In a similar manner the art and science of illuminating engineering needs a treatment which will prevent light from becoming "cheap" in appearance now that it has become cheap in cost.

The large public utility corporations afford excellent examples of co-operation. The daily meetings of the commercial section, the discussions of every issue having a direct or indirect bearing on their business, the blunt but kindly criticisms of the commercial manager, the morning bulletin board uncompromisingly revealing the discrepancies of each representative—all these measures contribute cumulatively to the existence of an *esprit de corps* which with intelligent individual effort can only mean success.

It is this sort of thing which is needed amongst manufacturers of lighting accessories, with the idea of broadening the perspective of each man in the organization. But in carrying out such a plan the manufacturer should weigh carefully the question of *remuneration.* At one time, not so far remote the representatives of life insurance companies were objects of contemptuous ridicule, and it was generally assumed that they had degenerated to such occupation much as water seeks its lowest level. To-day these men have won respectful recognition, but it has only been due to the action taken by their employers in realizing before it was too late, that while public impressions are based upon appearance and personality, both are dependent upon a reasonable cash equity.

As a rule sales-representatives of public utility corporations are men who, unfavored by fortune, have *perforce* "carried the message to Garcia" voluntarily. The remuneration for this class of labor, while not comparable as yet to the earnings of those engaged in occupations involving less technical knowledge and responsibility, has been generally and materially increasing during the last few years, and it is to be hoped that the wage of those engaged in selling lighting ac-

cessories may likewise be increased. It must be regretted that not every corporation dealing with the sale of lighting appliances realizes the tremendous influence for good or evil exercised by their sales force, not only as a result of their individual knowledge, but of their general calibre as well.

Decorative Lighting in Hamilton, Ohio

Some time ago the wide awake citizens of this Ohio town decided that it should keep pace with modern municipal improvements, the most conspicuous among which at the present time is the new public lighting, otherwise known as "decorative street lighting." As the tungsten lamp used in clusters in ornamental standards has become the leading system of such illumination it is also often referred to as "cluster lighting." The movement was cordially supported by the Chamber of Commerce and the City Council, and was largely aided by the Retail Merchants' Association.

As a result of the agitation a handsome system of tungsten cluster lighting has been installed in the principal business center. Night and day views, showing a section of this installation, are given in Figs. 1 and 2. Fig. 3 gives a view showing the details of the lamp standard.

Added interest is given to this installation for the reason that Hamilton is one of the few cities in this country having a municipal electric lighting plant. The installation was put up under the direction of the superintendent, Mr. James O'-Toole, of the municipal electric light plant.

Decorative street lighting is decorative in other respects than those resulting from the light. The posts, or standards, in the cluster system are a prominent feature in the appearance of the street. Long before decorative lighting in the present sense of the term was known, Paris was famous for its street lighting. This fame rested upon no better lighting unit than the old gas flame on the traditional lamp post. But these posts were set very near together, and as the principal boulevards afford a long vista, the effect of the rows of lights extending off into the distance was very striking. Thus in our boasted "new street lighting" history is but repeating itself. The lamp post has reappeared in a glorified form, which is an architectural decoration to the streets by day as well as a means of artistic illumination by night.

FIG. 1.—TYPE OF STANDARD USED.

FIG. 2.—NIGHT VIEW OF NEW ORNAMENTAL LIGHTING, HAMILTON, OHIO.

FIG. 3.—DAYLIGHT VIEW, SHOWING ORNAMENTAL EFFECT OF NEW STANDARDS.

Getting Away from the "Chandelier" in Fixture Design

Custom lives long and dies hard; witness the two buttons that still persist on the tails of the frock coat. The use of these originated in the swashbuckling days when a sword was an essential part of a gentleman's dress. In order that the weapon might be instantly unsheathed, for which the demand might arise at any time, the front portions of the coat skirt were turned back and buttoned in the rear. The sword as a decorative or useful adjunct to civilian attire has long since passed away, leaving only these buttons as an unrecognized relic of a long vanished custom.

For ages the candle was the light-source of gentility; the masses had to be satisfied with rush-lights and pine knots.

FIG. 1.—SHOWING ARTS-AND-CRAFTS INFLUENCE.

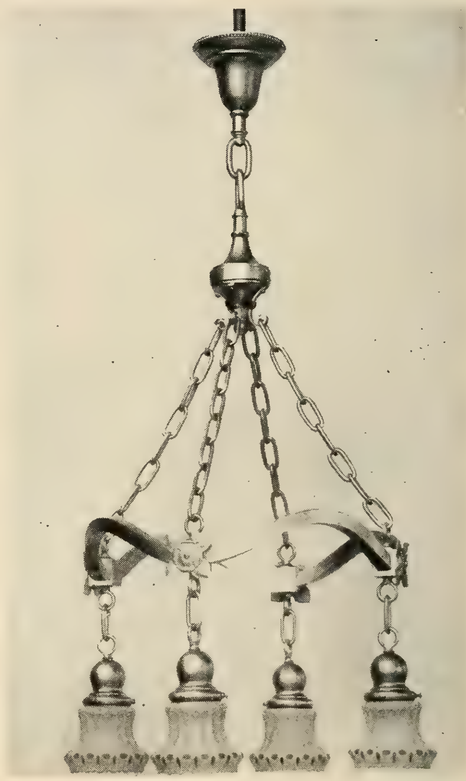


FIG. 2.—A STUDY IN CURVES.

The chandelier, or candle-holder, was an object which received the attention of the royal architect and state decorator, and was developed into a thing of exquisite beauty; thus it has exemplified the truth that "a thing of beauty is a joy forever," for not even the complete change in social and political institutions nor the extinction of the candle as a practical illuminant

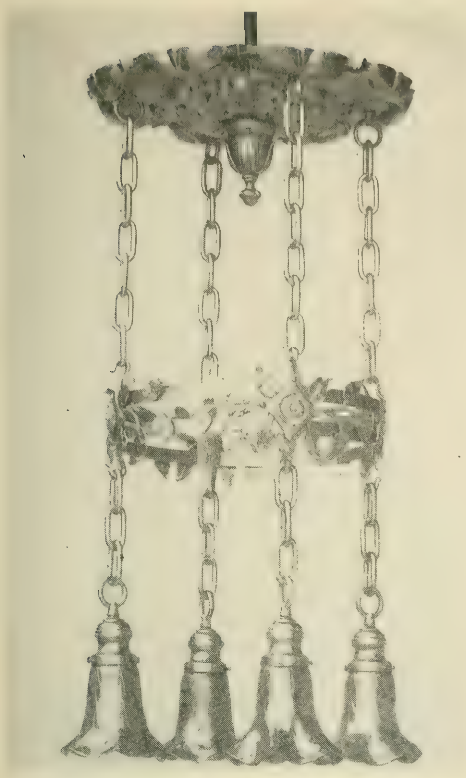


FIG. 3.—A SUCCESSFUL MODIFICATION OF THE "SHOWER."

have been sufficient to overthrow the supremacy of the chandelier as a lighting fixture. When illuminating gas came in we were served with gas "candles," and when the electric light made its appearance the electric "candle" immediately came into being.

A curious feature of the remarkable persistence of custom in this instance is the fact that it has been most in evidence in America, the one country supposed to be least influenced by precedent and custom. It is only within the past few years that any considerable progress has been made toward getting away from the candle-holder idea in lighting fixtures. The infinite possibilities of the electric light for variety and originality of treatment have been scarcely touched upon. The tendency to break away from the traditional chandelier is undoubtedly increasing, and is destined to become a leading force in the design of lighting fixtures.

As might be expected, the Western manufacturers have shown the greater tendency in this direction. A few recent examples are shown herewith. The essential feature in all of these is the absence of the rigid central stem, or body, and the substitution of chain support and construction which plainly declares electricity as the source of light.

In Fig. 1 the mechanical principal of supporting the lamps and shades by chains held apart by a spreading device is consistently carried out, with an excellent sense of proportion. The design is essentially angular, but is relieved by a judicious use of curves. The artistic motive is modern, and would harmonize with Mission or Arts-and-Crafts schools of decoration and architecture.

Fig. 2 involves the same basic mechanical principle, but with a different treatment of the spreading device, in this case following the Art Nouveau principle of decoration. Harmony of line and simple

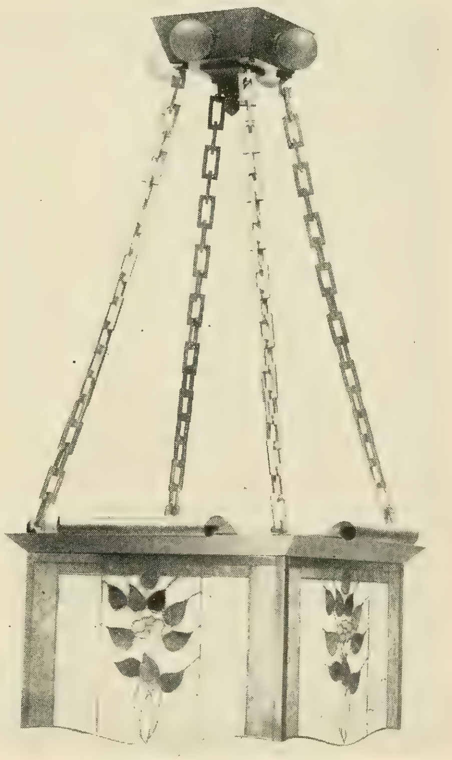


FIG. 4.—FOR THE MORRIS ROOM.

FIG. 5.—A COMBINATION OF DIRECT AND INDIRECT LIGHTING.

curves are depended upon for artistic effect, superficial decoration being used to a slight extent.

In Fig. 3 the spreading of the flexible supports is accomplished by the use of a ceiling placque. The monotony of a number of simple pendant chains is relieved by the use of a decorative band midway between lamp and ceiling. The treatment is distinctly Art Nouveau in motive, leaves in their natural form being produced in wrought metal effect, while the shades, both in shape and color, closely simulate flowers. The fixture is essentially decorative and as such would be suitable in either a room in which only a moderate intensity of illumination is desirable, or where supplementary light-sources, such as table lamps, would be used. The finish would naturally correspond with the wrought metal effect, rich bronze having the preference.

Fig. 4 is a design which would particularly appeal to a new school of architecture which differs somewhat from the Arts and Crafts. It is perhaps nearer the Morris ideas of decorative art. The illustration does not indicate the interior construction of the art glass shade. Assuming that this is a large translucent reflector equipped with a single Mazda or tungsten lamp, the fixture is a highly efficient lighting unit, as well as distinctly original and pleasing in its artistic design. The lamps on the ceiling support could be omitted without detriment to the general usefulness or appearance of the fixture.

Fig. 5 is worthy of notice from the illuminating engineering viewpoint, as well as the artistic side. It is an interesting combination of semi-indirect and direct lighting. The former is accomplished by the use of the Alba glass hemisphere, which would deflect a considerable light to the ceiling, while transmitting the balance as direct illumination, while the pendant reflectors constitute a highly efficient direct lighting unit. The composition is excellent, both the curves and the weight being in perfect harmony.

Fig. 6 is a ceiling fixture, utilizing the metal ribbon principle which was noted in a previous article. The essentially angu-

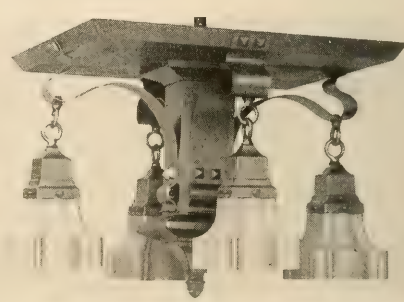


FIG. 6.—CEILING PLAQUE, WITH RIBBON EFFECT.

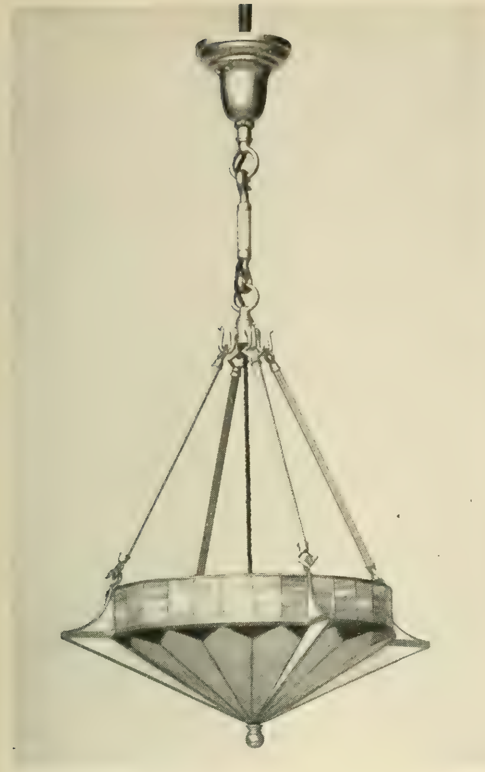


FIG. 7.—A SEMI-INDIRECT FIXTURE.

lar construction is relieved by the graceful curves of the supports and set off by the rivet heads. The fixture is reasonably efficient as an illuminating device and very modest in price, and would acceptably fill many requirements in the cottage or bungalow.

Fig. 7 is chiefly interesting from the illumination standpoint, representing an effort to combine both the direct and indirect methods of illumination. The design is what would be best designated as modern. The fixture could be made an efficient indirect lighting unit by the use of a large prismatic reflector and tungsten lamp inside the art glass construction. The transmitted light would be sufficient to bring out the color effect of the leaded glass.

Fig. 8 shows a successful modification of the popular "shower" type of fixture, by the use of a band of metal to relieve the severity of the chains.

FIG. 8.—A CLASSICAL TREATMENT OF THE SHOWER.

The Artistic Side of Modern Illumination

By R. L. Hirschfeld.

Modern illumination, in this practical age, consists of getting the most efficient light in the simplest manner. All manner of lighting fixtures and lamps are designed with a view to the artistic embellishment of the surroundings, but the main thought, however, in the construction and arrangement of the present day lighting effects is the ultimately practical purpose for which the light is intended.

Therefore, in treating this subject, "The Artistic Side of Modern Lighting," we must keep in mind, not only the artistic side of the fixture or lamp, but the practical side as well. These two fundamentals go hand in hand, and wherever they are proportionately combined, we find the ideal lighting scheme.

This combination has doubtless been the result of the ingenuity of present day designers, and the practical arrangement of lamps is found especially in those made in this country, owing no doubt to the very strict laws governing the installation of electricity in any form in the United States.

It is a generally accepted fact that the interior treatment of the rooms of a house governs the type of lighting fixture to be used, as, for example, a home treated in Colonial design of architecture demands a Colonial type of fixture.

It is, however, a common occurrence for the house builders to vary the treatment in the different rooms, so that we find in some of the modern homes to-day, French designs in one room, English designs in another and Dutch designs in the third.

Many of the fixtures and lamps in use to-day we find are copies of those periods that were famous for their originality and of such lasting beauty that they are still universally used throughout the world. We refer to such periods as the Elizabethan, French, Classic, Flemish, etc. Nowhere can we find more beautiful designs than in the detail of a Louis XV. or XVI. bracket or chandelier.

FIG. 2.—A STUDY IN HARMONY OF LINE.

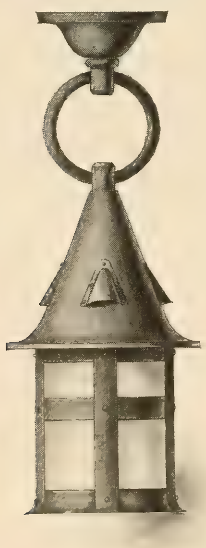


FIG. I.—"QUAINT AND OLDEN."

The ornamentation of the furniture, draperies and interior trim, we find reflected in the castings of back plates, standards and arms of the lighting fixtures of the periods. For such room arrangement there is a wealth of design to select from, and one finds variations of these types almost everywhere.

As to the modern designs, typified by the general tendency in house building all over this country to-day, there is one type that stands out clearly, the influence of which has been felt as keenly as any of the older types, and that is the new art or Craftsman type of design.

There is, and has been for a long period of time, a great demand on the part

FIG. 3.—ART NOUVEAU.

of the people for simplicity, and we find this feature reflected in the style of homes that are being built to-day.

This type in a lighting fixture is, in a true sense, a modern conception, yet its influence dates back to the very earliest period when lights were originated, or such forms as were used for the support of lights.

While there has always been, to some extent in every form of design, a Crafts type, it is to-day more generally accepted as a type than ever before.

There is no line that can be drawn definitely bounding this style of modern lighting, but one fact stamps it as the ideal for the style of house it is to be used in, and that is its artistic simplicity and practicability. It has a tendency toward severity in lines, but it is of such character that it is always pleasing, and a freshness about the design that is welcomed by the disciple of the simple life.

One sees reflected in the straight, simple lines that characterize the Crafts type of house, the fundamental lines that are used in the fixtures. Unquestionably, this type of design has created a deeper sense of the practical, and also an appreciation of man's handiwork than has anything else produced in the last fifty years.

One acknowledged fact is that strong, bright lights are detrimental to health, and we find that nowadays all lights that are used for the illumination of a home are shaded or protected. As a direct result of this condition, we find among the popular fixtures, the hanging dome, used largely in the dining room and library, and hung in such a position that the lights are hidden from view, but a beautiful, clear light is cast upon the table.

Artistic effects in this style of fixture are unlimited, and many are the beautiful designs incorporated by various means in the dome itself. Leaded glass offers unusual opportunities in design and colorings.

There is a wide range of opportunity to match interior decorations, and as we strive for the practical as well as the artistic, so in determining the proper style of lighting for the various rooms of a home, we should be particular as to the lighting treatment for each room.

The generally accepted arrangement for artistic lighting in the modern home might be summed up as follows: In the living room, which is to-day the most important room of the house, being that which its name implies, the room in which we live, the ideal arrangement is this, side brackets for general illumination and table lamps with properly shaded lights for the more direct use of light for work or reading. Should the room be very large, ceiling lights in clusters are desirable.

FIG. 4.—A COMBINATION OF PLASTIC AND PICTORIAL ART.

FIG. 5.—GOOD LITERATURE DESERVES GOOD LIGHT.

In lamps, as well as in domes over the dining room table, the most practical arrangement is arrived at by the shade that completely hides the lights, but sheds a clear radiance at the point most needed. In the lamp also is the artistic temperament allowed greater license, and nowhere can more beautiful and artistic lamps be found than in this country, a wealth of design for the person to select from, but always the truly artistic and useful lamp should be the practical one.

Halls and vestibules are artistically lighted by the use of ceiling lights and side brackets, and bedrooms are generally best lighted by placing side brackets nearest to the vantage points, such as dressers, beds, etc. The bed lamp has now become a decided fixture among electrically lighted homes, and we find some very artistic and interesting types being especially designed for this purpose. Color schemes are harmonized, both in the room decoration and in the lamp or fixture colorings.

One of the most important features of an artistically lighted room is the arrangement of the lighting device in such a manner that the fixture or lamp is not the prominent feature of the room, but so blended with the general color scheme that they are not noticeable, but are just a part of the general scheme. How often an otherwise beautiful home is spoiled by the glaring brilliancy of very ornate and much detailed fixtures or lamps. This is not of necessity due to the expenditure of a large amount of money for the lighting appliances. In fact, the same inartistic results are often obtained by the use of cheap fixtures which are not in sympathy with the surroundings. A little thought and study in selecting lighting effects will result in continued pleasure.

Here is an interesting story which illustrates how much more important the artistic side of the fixture was than the practical.

A coal miner in the Newcastle mines of England, after receiving his monthly pay, went to town with his lady to buy something for the house. Stopping in front of a fixture store, they were struck by the beautiful appearance of a handsome chandelier. They inquired the price of the salesman, and upon being told promptly paid it and asked to have it wrapped up. The salesman said that he would send it to them and have it installed, but the miner was obdurate and was determined to take it with him. In the course of a week or so the salesman, being in the neighborhood of the miner's home, stopped in to see how the fixture looked in place. The lady of the house proudly showed him the beautiful fixture, placed on top of the piano with no apparent attempt at making use of the lighting features of the fixture. They had purchased it merely for its artistic beauty and not for the use of its lights.

There is one type of lighting which is at present in an experimental stage, but bids fair to revolutionize the accepted standards of lighting, and that is indirect lighting, which turns the light toward the ceiling by which it is reflected all over the room. Very successful results have been obtained in lighting large spaces and public buildings and offices as well as in rooms of houses, and we watch with interest the development for general use of this new type of modern lighting.

The Illuminating Engineering Society

In another section of this issue will be found a contribution on this subject by Mr. Albert J. Marshall, which is well worth the careful perusal of both members of the society and those who are interested in its purpose. Mr. Marshall's views are particularly worthy of thoughtful consideration from the fact that he is one of the charter members of the society, and has perhaps devoted more actual time and effort to promoting its work than any other single individual. Not only the extent but the value of this work has been recognized by his election to the secretaryship of the New York Section for the third term. To his efforts in this capacity may be attributed the fact that the New York Section for the past two years has contributed a majority of all the papers published in the proceedings, and also that these papers cover a wide variety of subjects.

Mr. Marshall might be called a "self-made" illuminating engineer. His first work in connection with illumination was with the Baltimore agency of the Welsbach Company. His unusual and enthusiastic interest in the subject in this position attracted the attention of Mr. V. R. Lansingh, the manager of the Holophane Company, who secured his services for publicity work. In this capacity Mr. Marshall gave popular lectures on illumination in many of the larger cities of the country. After a year of this work he took charge of the Architectural Department of his company, and has since been an enthusiastic advocate of giving greater importance to the esthetic and psychological aspects of illuminating engineering. Like all enthusiasts, Mr. Marshall has incurred the reputation, to some extent, of being an "extremist," or in more colloquial phrase, a "faddist."

However others may differ with him in his opinion as to the proper scope and future prospects of the Illuminating Engineering Society, they must at least concede that his opinions are those of an active worker in the field, and one whose professional duties have been such as to bring him into contact with existing conditions and opinions to an unusually large extent; while his efficient work in behalf of the society gives him license to offer sincere criticisms without being subject in the slightest degrees to the imputation of ulterior motives.

The statistics taken from the last report of the general secretary give at least a substantial foundation for much of what Mr. Marshall says. The fact is that conditions in the lighting field have changed so rapidly within the past ten years that it has been impossible for even the most careful observers to predict the development for any considerable period ahead.

The Origin of Illuminating Engineering.

The first recorded mention of lighting as an engineering problem dates back only to the beginning of 1896. From the date of this first suggestion of the new science to the organization of the Illuminating

Engineering Society was a span of but a single decade, which shows remarkably rapid growth compared with the evolution of other branches of engineering from the main subject of applied science.

To a considerable degree the organization of the society was in anticipation of future developments rather than the crystallization of results and demands already in existence. Of this the name of the society bears evidence. It was recognized by its founders at the time that to give it a name corresponding with other similar organizations, such as "Association of Illuminating Engineers," would be either to restrict its membership to a mere handful of those whose claims to the title were necessarily self-assumed, or to accept laymen interested in the subject, which would give to the association a character inconsistent with its title. In fact, the immediate object in forming the society was to establish illuminating engineering as a distinct science and profession by securing co-operation and concerted action among those actively engaged in pursuits which should properly be considered different phases of the general science and art of illumination, constituting the field of illuminating engigineering. Both the science of illuminating engineering and the qualified illuminating engineer were then in the first stages of evolution. The society was like a university just opening its doors to the public—all entering pupils were freshmen—with the exception of a few scattering cases that had received special training in connection with other professions.

From this time forward the development of both knowledge and general interest in the subject of illumination has proceeded with unprecedented rapidity. This has been due to a considerable extent to the remarkable improvements and discoveries in the means of producing light that followed immediately upon the organization of the society, which of course was a happy but unforeseen coincidence.

Another circumstance contributing to this rapid growth was the overripe condition for a general reform in methods of utilizing artificial light which, by common consent, had fallen far behind both the methods of producing light and the practices prevailing in other utilities.

Scope of the Work.

The scope of the society was wisely made as broad as possible at the beginning, the single provision for membership being that the applicant be interested in the objects of the association, which, briefly stated, were to improve conditions and practices in illumination; and the name Illuminating Engineering Society was aptly chosen as expressing this broad basis of operation.

The number interested in illumination is manifestly very large, in fact, it is much easier in the last analysis to point out those who are not interested than those who are, for the division would exclude only infants and the totally blind. It may be worth mentioning here as a curious and surprising fact that illumination is more carefully considered in modern institutions for the blind than perhaps in any other class of building, it having been found that the effect of light upon the body has a powerful influence upon the mental state, irrespective of any visual effect, so that special provision is made for the admission of sunlight and the use of ample artificial illumination. The lack of interest on the part of infants should be compensated for by additional interest on the part of their parents.

In strict logic, therefore, all creation ought to be members of the Illuminating Engineering Society—a fact which we commend to the consideration of the new membership committee.

Analysis of Membership.

There is a statement in Scripture to the effect that "where man's treasure is, there will his heart be also," which is as true to-day as the day it was written. Now, there are a large number of men whose treasure is derived from the sale of luminants, and the apparatus for converting them into light and illumination. Their interest in the society is therefore a thoroughly practical one. That they have recognized this is very clearly shown in the statistics of membership which Mr.

Marshall quotes. Thus, out of a total membership of 1,530, 1,231, or 82 per cent. are directly concerned in the manufacture or sale of luminants and lighting apparatus. Of those who openly claim the title of Illuminating Engineer there are but four, or three-tenths of 1 per cent., while of those taking the more general title of Consulting Engineer there are 47, or 3 per cent. In the personnel of its membership, therefore, the Illuminating Engineering Society is commercial by a large majority.

It would probably be found on a similar analysis of other professional associations, as, for example, the American Institute of Electrical Engineers, that a correspondingly large proportion of its members were connected directly with some manufacturing or selling interest; but this fact cannot be compared with the case of the Illuminating Engineering Society, for in the former the members are without exception electrical engineers, whereas the members of the latter who are interested in the subject commercially are none of them illuminating engineers, according to their own admission.

The analysis of the membership of the Illuminating Engineering Society shows the society to be constituted in general as follows:

(1) A small number, not exceeding 10 per cent., of technically trained men who are professionally engaged in some of the scientific phases of the general subject of illuminating engineering. Among these is the single handful of practicing illuminating engineers, the balance being teachers or investigators.

(2) Another small minority—perhaps 10 per cent.—who are endeavoring to qualify themselves for the profession of illuminating engineering, or to sufficiently familiarize themselves with its principles to assist them in their regular work.

(3) The majority—75 or 80 per cent. —who are interested in the work of the society chiefly as a means of general publicity, tending to further their financial interests, and who are therefore willing to contribute annually to its financial support.

From the general accuracy of these conclusions there is no escape. Let no one jump to the conclusion, however, that the Illuminating Engineering Society is simply a commercial "scheme." Nothing worth while can be accomplished in the present state of civilization without the expenditure of money. Money represents labor; it is the result of labor, and it will secure the results of other labor. No enterprise, whether religious, social, political, philanthropic, humanitarian, or scientific can even exist, much less thrive and prosper, without a due supply of this form of potential human energy. Those who pretend to despise the power of money are either deluding themselves or attempting to delude others. It is just as legitimate for the manufacturer of illuminants or lighting supplies to contribute to the promotion of illuminating engineering as it is for the church member to contribute to his pastor's salary, or for the citizen to contribute, by taxes or otherwise, to the upbuilding of his city. There is but a single qualifying condition in the case, viz., the money contribution must carry with it no restriction upon those actively engaged in the work. There must not even be any implied moral obligation. The preponderance of commercial members in the society is in itself neither an impediment nor a menace to its progress; it may, however, adversely affect the society indirectly.

Change in Conditions.

When there were practically no illuminating engineers, and the science and profession of illuminating engineering were yet to be, there was no necessity or occasion for discrimination in membership. These conditions do not maintain at the present time. Illuminating engineering is recognized by both the professions and the laity, and there is no longer any hesitancy on the part of those qualified in professing the title of Illuminating Engineer; while those who assumed the title without other warrant than that it was an assistance in their work have wholly ceased from the practice. In fact, there is rather a hesitancy on the part of those fully qualified to use the title than for those unfit to assume it.

In the rapid development of conditions

progress has overtaken the society and actually left it in an anomalous condition. To-day it can neither be classed among technical associations, like the several other engineering associations, nor among social movements, of which there are numerous examples.

In its name and objects the society is rather of the social than the scientific order. Membership neither requires nor signifies that the person is an illuminating engineer, and as a matter of fact few of its members claim the title. In its proceedings, however, it is distinctly of the scientific order, they being devoted entirely to the discussion of the technology of the subject of illumination. This anomaly in its membership and work has undoubtedly affected its progress adversely by keeping out of the society a very large and important contingent, viz., the architectural profession. According to the secretary's report referred to, less than 1 per cent. of its members are architects. The fact remains, nevetheless, that the architect is the responsible source and court of last appeal in all building construction, and upon his word depends the use or rejection of the principles and practices prescribed by the illuminating engineer.

The Architect's Position.

There are something over ten thousand architects in this country, and four consulting illuminating engineers. Assuming that all of the latter belong to the society, which is a fair supposition, what is the logical inference? Illuminating engineering is being done by the architects or electrical engineers in such a large majority of cases that the exceptions represented by the work of the consulting illuminating engineers is scarcely worth considering. To be sure, there is a certain amount of illuminating engineering being done by the illuminating engineers connected with commercial concerns, but even the sum total of this does not cut a large figure in comparison with the grand total. Generally speaking, the architect lays out the lighting, sometimes assisted by the fixture manufacturer; he is, *de facto,* the illuminating engineer that is doing the actual work. Of all people, then, who should be interested in the subject the architect naturally comes first; in the Illuminating Engineering Society he comes last—with the exception of the illuminating engineer. Until this condition is reversed the society will have failed to realize its ultimate purpose, no matter how many other members it may have.

There is no other profession that is so jealous of its professional rights, prerogatives, and dignities as that of architecture. We need not enter into an analysis as to why this is true at this point; it is generally admitted on all sides. That the architect's interest in illuminating engineering is rapidly growing there is plenty of evidence to show; but there is slight indication of his increasing interest in the Illuminating Engineering Society. The traditions of his profession render it very unlikely that the architect will affiliate himself with any association that is materially less particular in its qualification for membership than his own professional bodies. An association of illuminating engineers would undoubtedly appeal to a considerable number of the architectural profession; a society made up of the heterogeneous interests involved in lighting, with an overwhelming majority of those commercially interested only, is not up to the architect's standards of professionalism.

Necessity of Co-operation Between Architect and Illuminating Engineer.

The active membership of architects is essential to the society for two reasons: First, because a large majority of lighting installations are laid out by architects, and it is desirable that they keep abreast of the latest discoveries and principles of the science; second, because illuminating engineers in the great majority of cases must work under the general direction of the architect, and it is necessary that the latter appreciate the value of professional service of this kind before it will be employed to any measureable extent. In other words, if the architect is his own illuminating engineer he ought to be as competent as possible in this line, and it generally lies with him whether to do the work himself or to employ a specialist in lighting.

"A little knowledge is a dangerous

thing"; it often leads its possessor to a false estimate of the extent and importance of the knowledge which he does not possess. The greater the accumulation of knowledge on any particular subject, the smaller it seems in comparison with what still remains to be learned. Probably most architects would admit that among the many subjects demanding their attention they have given less thought to the subject of lighting than its importance demands. It is certain that a greater familiarity with the numerous factors which make up the problem of modern illumination would give them a higher opinion of the science and profession of illuminating engineering.

There can be no surer way for the consulting illuminating engineer to come into his own than for the architect to become more familiar with the technology of lighting. If it were not for the possibility of giving offense we would quote the familiar adage, "Fools rush in where angels fear to tread." The novice will often fearlessly undertake what the experienced professional would face with hesitancy and doubt. Better practices in illumination, which is the ultimate object of the society, would be immensely enhanced by a better mutual understanding between illuminating engineers and architects.

When the architect, for one reason or another, wishes to relieve himself of the details of laying out the lighting installation he commonly shifts the matter to either an electrical engineer or a fixture manufacturer. Very commonly the responsibility is divided between the two, the former locating the outlets and the latter designing the fixtures.

The Fixture Manufacturer's Part in Illuminating Engineering.

The same general arguments, then, apply as to the desirability of the fixture manufacturer and electrical engineer familiarizing themselves with illuminating engineering, as in the case of the architect. The representation of these two callings in the membership of the society is relatively very small. The fault in this case lies to a considerable extent with the fixture manufacturers, who have allowed a mistaken notion of their own business interests to obscure their better judgment and foresight. Manufacturers are naturally opposed to any radical changes in the line of their business, for the reason that changes mean investment in new equipment and the wiping out of a corresponding amount of their capital invested in the old.

There was no escaping the fact that better practices in lighting would have to begin with better, or at least different, methods of design and construction of fixtures. In looking at the immediate necessity of changing dies, patterns, etc., the fixture manufacturer failed to see the equally obvious fact that a distinct reform in methods of lighting would necessarily render existing installations obsolete, and so open up an enormous field for replacing the old with new. Generally speaking, the fixture business has been one in which there were no "repeat" orders; every customer was a new one, and when once supplied was out of the market for all time. If illuminating engineering were to have full sway it would relegate to the scrap heap so many existing fixtures that the manufacturers could not begin to supply the demand for their replacement, to say nothing of the new installations required. The fixture manufacturer, therefore, who keeps aloof from illuminating engineering or attempts to put obstacles in the path of its progress is pursuing a ridiculously short-sighted policy and standing in his own light.

On the other hand, the conspicuous attention given to physical efficiency in illumination in the proceedings of the society has, as Mr. Marshall points out, repelled the fixture manufacturers, decorators, and to a certain extent the architects, all of whom have been accustomed to consider the artistic effect of lighting as at least equal if not superior to physical efficiency. Here again there is urgent need of a better mutual understanding. There are some people who in buying clothes look only at their wearing qualities, and there is a certain class of cases in which such consideration is properly placed first; but this does not mean that there are not a great number of instances in which looks count for as much or more than wearing ability; the same is true of lighting instal-

lations, and will remain true for all time. It is important that this be recognized by illuminating engineers and by the society, to the end that active and sympathetic co-operation between the manufacturer and the engineer may take place.

Relation of Ophthalmology to Illuminating Engineering.

Another profession which should have a larger representation in the society than it has at present is ophthalmology. The mutual advantages of such membership would perhaps be more evenly balanced than in the case of any other profession. The general lack of knowledge among ophthalmologists concerning the effect of various kinds and qualities of illumination upon the eye is freely admitted by the practitioners themselves, while the work which the society has done along this line thus far has been insignificant. The knowledge of the relative advantages and disadvantages of different methods of illumination from the physiological standpoint is in a very unsatisfactory state compared with the knowledge of the physical and commercial phases of the subject of illuminating engineering. Ophthalmologists and illuminating engineers stand equally in need of more positive information concerning this subject, and each needs the other's assistance in furthering investigations and arriving at safe conclusions.

Early Policy of the Society.

The wisdom of the founders of the society in opening its doors as widely as possible and fostering interest in the subject in general rather than in increasing the special knowledge of the few is unquestioned. So also is the value of the work which has been accomplished, as recorded in the proceedings and evidenced in the general acceptance of the science and profession. That the same basis of organization and method of work will produce equally satisfactory results in the future, however, there is room for serious doubt. The opinion prevails among a number of the members who have been most closely identified with its career that the society must soon decide whether it is to be a professional association made up of those actively engaged in the practical work of illuminating engineering or its collateral branches, or whether it is to degenerate into a commercial club dabbling with various scientific investigations to give it a professional cast in the eyes of the public.

Future Work.

Great as the progress has been in the advancement of knowledge of the subject and the education of the public up to the appreciation of the importance of good illumination, the work has only been fairly begun. The work of the society will be finished when every architect is as familiar with the principles of illuminating engineering as with those of mechanical construction, and either puts them in practice himself or delegates his work to a bona-fide professional illuminating engineer; when fixture manufacturers apply the principles of the science in the design and construction of their wares; when the ophthalmologists and illuminating engineers are working in harmonious co-operation in solving problems of mutual interest; when all manufacturers realize that proper illumination is as important as proper machinery and facilities, and when there are no more scientific problems to be solved.

Physiological Effect of Light

We have often called attention to the necessity of careful investigation by ophthalmologists of the effect of various kinds and qualities of illumination upon the eyes of those using them. It is very gratifying to record the first systematic effort in this direction in America. Dr. Charles H. Williams, an ophthalmologist of Boston, who will be remembered in connection with the recent experiments conducted in collaboration with Dr. Louis Bell on the relation of monochromatic light to acuity of vision, has recently investigated the condition of the visual organs in a number of cases of persons that have been subject to the mercury vapor light for different periods and under various conditions. He gives the results of his investigation in an article contributed to the *Electrical World,* which is reviewed in another department of this issue. His results were absolutely negative—*i. e.,* he found but very little deviation from the normal in the cases examined, and where such deviation existed it was readily attributable

to other causes, especially to uncorrected optical defects in the eyes.

The investigation and the conclusions are notable from two viewpoints: first, as constituting a line of research that has heretofore been unused, and, second, as showing that the surmises that have been frequently expressed, that a light differing so radically in its composition from daylight or the more familiar artificial light-sources might have an injurious effect upon the visual organs, are entirely without foundation. Weight was added to the possible truth of these surmises by the cases of cataract reported to have resulted from the use of mercury vapor light in Germany, the result in these cases being attributed to the presence of ultra-violet rays. The fact was generally lost sight of, however, that the quartz lamp was involved in the cases reported, which, as is well known, emits a large proportion of these rays, which are almost completely absorbed by the lead glass which is used in the tubes of the commercial mercury vapor lamp.

The result of Dr. Williams's researches may put our minds at rest as to any possible injury resulting from the use of the mercury vapor lamp in its present form, known in this country as the Cooper Hewitt lamp.

Science vs. Rhetoric

The Editor of *Progressive Age* takes some exception to our comments on Mr. Blinks' paper before the Iowa Gas Association. "That paper," says the Editor, "was written by a man in contact with actual conditions and no amount of rhetorical derogation will rob his statements of one iota of their worth." And then, after discussing briefly the proposition that the "light-source of great quantity and high efficiency and economy" is the coming thing in illumination, he further observes: "The merits of gas lighting speak for themselves and gas men are not much frightened at electric light competition." This sounds suspiciously like the boy whistling to keep up his courage in the dark, for the writer freely admits our contention in the next sentence: "If there is any fault to be found, it is that gas men have not endeavored to produce good lighting results to the extent they should. But that does not mean that the business is going to move right over to electricity the first thing to-morrow morning. 'There's much to be done ere it comes to that.'" That gas lighting has ample merits to maintain its position in the lighting field we have always insisted, in season and out of season. That, as our contemporary says, the gas men have not given the attention to producing good lighting results to the extent that they should, that is, to the extent which their electrical competitors have used the scientific principles of illumination, we have also frequently pointed out, not in derogation of our friends in the gas industry, but for the friendly purpose of arousing them to the "actual conditions." This is precisely the point that we criticised in the paper in question; while it did not ostensibly discredit illuminating engineering, it at least damned it with faint praise.

As to gas illumination moving over to electricity to-morrow morning, we would suggest a slight amendment in the Editor's quotation: *"There's much to be done or it will come to that."*

Light and Illumination in the Cloak and Suit Industry, New York

Bulletin No. 4 of the Joint Board of Sanitary Control in the Cloak, Suit, and Skirt industry has just been issued. A summary of the results obtained from the second general inspection of shops in Manhattan and Brooklyn is given, the first having been made in Febraury. 1,738 shops were examined, which gave employment to 45,199 persons, of whom 10,108 were women. The following summary of lighting conditions is given:

Shops illuminated by gas, 1,086;

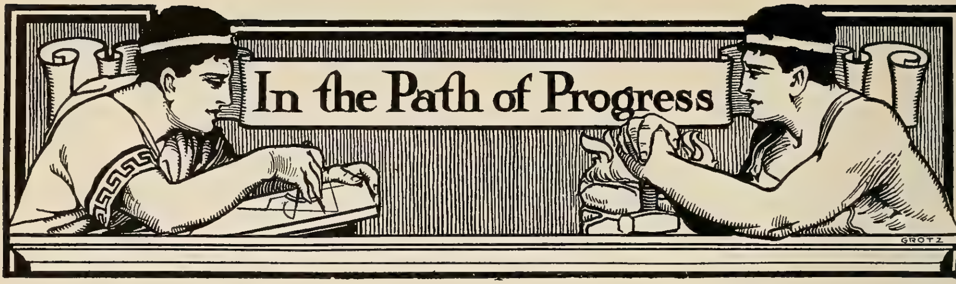
Shops in which artificial light is needed during the daytime, 294;

Shops in which lights are needed, 466;

Shops in which light is bad in halls, 124;

Shops in which light is bad in toilet-rooms, 188.

Half of the shops using gas illumination were on the East Side. The inspection included 1,583 buildings in which there were shops of other trades, and the inspectors give as their opinion that the sanitary conditions in the cloak shops are much better than the shops of many other industries.



The International Municipal Congress and Exposition

As noted in our advertising section for several months past, this congress is being held as we go to press in the Coliseum, Chicago, during the two weeks, September 18 to 30. A comprehensive programme of papers and discussion has been arranged in addition to the exhibits and special features of the exposition. The last week of the congress is coincident with the convention of the Illuminating Engineering Society, and those who attend the latter will find it well worth while to visit this exposition. The session of Monday, September 25, which will open at 2 p.m., will take up the subject of public utilities, Public Lighting being the principal topic, which will be presented by Mr. E. Leavenworth Elliott. Mr. Bion J. Arnold, of Chicago, will be chairman of the session, and the discussion will be opened by Mr. H. M. Byllesby, President of the Civic Federation of Chicago, followed by Mr. Edward W. Bemis, of New York.

The Opalux Company Enlarges Its Line of Illuminating Glassware

The Opalux Company, New York, which has become known as the selling organization for the reflectors of this name, and has recently added the Camia, Gletieco and Carrara lines of lighting glassware manufactured by the Gleason-Tiebout Glass Company, Brooklyn, New York, who were and are the manufacturers also of the Opalux reflectors. This gives the company a very complete line of lighting accessories having distinctive merit.

The company has also retained Mr. F. Laurent Godinez as consulting illuminating engineer, who will devote the portion of his time allotted to this client to the development of new applications of the various types of glass to illuminating problems, giving particular attention to combining artistic quality with illuminating efficiency. Mr. Godinez is well adapted, both by nature and training, for this particular work; and as the field is an exceedingly large one and as yet comparatively little worked, we may expect to see some important developments as a result of his labors.

A New Reflector for Industrial Lighting

The Holophane-D'Olier steel reflectors, aluminum finish, have become well and favorably known for industrial lighting, and have come into large use for this purpose. Following their general policy of seeking for constant improvements, the Holophane Company, Newark, Ohio, have developed a white enamel reflector for similar purposes in order to avoid the difficulty which arose in certain cases where dust or chemical fumes interfered with the aluminum coating. The following description of these new reflectors has been furnished us by the company:

These new reflectors here illustrated are

A NEW PORCELAIN ENAMEL HOLOPHANE-D'OLIER REFLECTOR.

finished both inside and out with a white enamel, which has reflecting value about 18 per cent. higher than any other at present available. This enamel is not affected by chemical fumes or by weather conditions and is very easily cleaned, which means that there is no corroding or other deterioration.

They are furnished with the extensive type of light distribution only.

The Holophane Company has just issued a very attractive leaflet covering its new enameled reflectors, in which complete data is given.

New Long Life Flame Arc Lamps

The new type "K" long life flame arc lamps, now being placed on the market by the General Electric Company, Schenectady, N. Y., are available in four styles—K-28 for operation on series alternating current, K-36 on multiple alternating current, K-51 on multiple direct current, and K-43 on power circuits, of all commercial voltages.

The mechanism is of the focusing type, automatically maintaining the arc in the same position, thus affording a constant and even distribution of light. A clutch of ingenious design permits the use of carbons varying considerably in diameter, and obviates all pick-up troubles due to clutch wear, thus insuring a perfect feed. The chain wheel is made of alloy with separate grooves for the upper and lower carbon holder chains. As the upper chain unwinds the lower winds, thus keeping the arc always in the same position. The cores and coils are suspended by means of compressing springs to prevent any flickering of the arc when the lamps are hung in places subject to vibration. Except in the series lamps no shunt spools are used, thus eliminating a prolific source of arc lamp complaints.

The lamps are provided with two globes. The inner globe may be of either clear or opalescent glass. Its open end is ground smooth and makes an air-tight joint with the machined surface on the under side of the condensing chamber against which it is held by a phosphor bronze bail spring. The outer globe is furnished in opalescent glass on the standard lamps, but may be obtained in clear glass. The method of holding the outer globe greatly simplifies the operation of trimming. The complete globe holder is hinged to the condensing chamber, a retaining spring holding the outer globe in position uniformly and without pressure. To lower the outer globe for trimming it is only necessary to loosen the wing-nut provided and allow the globe to swing downward where it is out of the way. This arrangement obviates the necessity for removing the globe, thus preventing the liability of its swinging in the wind and breaking by striking against the pole. The lamps may be used without the outer globe.

To trim, it is only necessary to lower the outer globe, take off the inner, remove the stub of the upper carbon, press the new upper carbon firmly in the spring holder, insert the stub of the upper carbon cut-off to the proper length in the lower holder, and replace the globe. The necessity for using only one new carbon at a trim greatly reduces the cost of maintenance, while the homogenous structure of the carbons affords many advantages over the cored type. The size of the carbons, ⅞-inch diameter, 14 inches long, gives great mechanical strength and decreases the breakage in handling.

The principle of ventilation applied allows the hot gases rising from the arc to circulate through the condensing chamber where they are cooled and the fumes condensed and deposited, thus keeping the inner globe clean and the illumination unimpaired. The casing is made of either copper or steel and is of the telescopic type to permit the ready examination of the entire lamp mechanism for adjustment or repairs without removing the condensing chamber or globes. The dome is a steel punching possessing great mechanical strength.

The arc voltage on the multiple alternating current lamp is regulated by a reactance, on the multiple direct current lamp by a resistance, and on the power circuit lamp by a resistance and a weight for properly balancing the arc voltages when two lamps are burning in series. In all the lamps the respective reactances or resistances are located within the lamp casing. The clutch rod regulates the distance from the top of the armature to the clutch lever, the proper arc pick-up being between ⅞ and 1⅛ inches.

The series alternating current lamp has an efficiency of .24 watts per mean hemispherical candle-power, and the multiple alternating current and multiple direct current lamps have efficiencies of .28 and .41 watts, respectively. The series lamps have a life of 90 to 100 hours, the multiple lamps 100 to 120 hours, thus combining high efficiency with long life.

Personal

Mr. W. Godfrey Boyd, 2d, has been retained as consulting illuminating engineer by the Haskins Glass Company, of Wheeling, W. Va. The addition of their new Haskins-Lucida line of globes and reflectors to their already extensive variety of illuminating glassware has made it necessary to increase the engineering and sales force of the company. Mr. Boyd was formerly with the incandescent lamp department of the General Electric Company, and is familiar with both the electrical and illuminating engineering phases of the subject of lighting.

Proceedings of Technical Societies

Programme of Papers to Be Presented at the Fifth Annual Convention of the Illuminating Engineering Society, from Sept. 25-28, Inclusive

Subject.	Author.
Presidential Address, "The Relations of Physico-Physiological Research to Illuminating Engineering,"	Dr. A. E. Kennelly.
Report of the Committee on Nomenclature and Standards,	A. J. Humphries, Chairman.
Report of Committee on Progress,	Dr. Louis Bell, Chairman.
Symposium on Illuminating Glassware	Bassett Jones, Jr., A. J. Marshall, L. W. Young, C. H. McCormack.
The Manufacture of Glass from the Viewpoint of the Illuminating Engineer	E. H. Bostock.
An Analysis of the Requirements of Modern Reflector Design,	F. L. Godinez.
Recent Small Gas Lighting Units,	F. H. Gilpin.
"Natural Gas, Its Production and Utilization"	G. S. Barrows.
Recent Developments in the Manufacture of Incandescent Lamps,	J. E. Randall.
The New Quartz Tube Mercury Arc Lamp	Geo. C. Keech.
The Law of Conservation as Applied to Illuminating Calculations,	Dr. A. S. McAllister.
The Photometry of Large Light Sources	Geo. H. Stickney and S. L. E. Rose,
The Analysis of Performance and Cost Data of Illuminants,	Ward Harrison and G. H. Magdsick.
Photometry at Low Intensities,	Dr. Louis Bell,
Evaluation of Lamp Life,	P. S. Millar and L. J. Lewinson.
Distribution of Luminosity in Nature,	Dr. H. E. Ives and M. Luckiesh.
Resume of Legislative Enactments on Illumination	E. L. Elliott.
Selling Illumination	F. B. Rae.
Influence of Suroroundings and Lighting Systems on the Illumination Required	J. R. Cravath.

ENTERTAINMENTS

For Members and Guests

Monday Evening—Reception and dance.

Tuesday Afternoon—Inspection trips by automobiles. Choice of trips to numerous points of interest, including the Fisk Street Station of the Commonwealth Edison Co., the Peoples Gas Building, Armour Institute, Lewis Institute, Chicago University and the International Municipal Congress.

For Visiting Ladies

Monday Afternoon—Automobile drive up the north shore through Lincoln Park and a part of the famous Sheridan Road to the Mission Tea Room.

Monday Evening—Reception and dance in the Florentine Room of the Congress Hotel.

Tuesday Afternoon—Automobile trip through the South Parks, passing Chicago University, to the South Shore Country Club.

Wednesday Afternoon—Theater party.

Wednesday Evening—Subscription banquet.

New England Section of the N. E. L. A.

The fall convention will be held September 27, 28, and 29, at Bretton Woods, New Hampshire. Among the four pa-

pers which will be presented one is of direct interest to illuminating engineers, viz., a paper by Mr. Norman Macbeth on the "Wire Type Tungsten Lamp."

International Photometric Congress

Besides the papers presented at this Congress, the question of photometric dimensions and units was the principal topic of a rather extended discussion, a summary of which is given as follows:

The question of photometric dimensions and units has been discussed by physicists at different times. It was the principal topic of a somewhat important discussion at the Congress of Electricians in Geneva in the year 1896. At that time, as a result of a report of M. Blondel, the Chief Engineer of Bridges and Roadways, a system was worked out having as its basis the bougie-décimale, the metre, and the second. The bougie-décimale was then supposed to be represented with sufficient exactness by the Hefner unit. Since that time, different changes have taken place, among which stand foremost the agreement between the National Laboratories of the United States, France, and England, on the use of a so-called international candle common to the three countries, which, by a happy coincidence, has almost the same value as the bougie-décimale. [It is well known that the bougie-décimale, or Violle candle, is the twentieth part of the platinum unit as defined by M. Violle, and that it was adopted in 1889 by an International Congress of Electricians at Paris as a photometric unit.]

The comparison of the Hefner unit and the Vernon-Harcourt candle with the bougie-décimale was, on the other hand, the matter of very exact measurements by the different National Laboratories. The results of these measurements were adopted by the International Photometric Commission at its session in 1907. These measurements have shown that the Hefner unit is equal to 0.90 of the international candle; so that all measurements which have been made in Germany with the Hefner unit can easily be converted into international units. It appears to the experts of the different countries that the time has now arrived to bring the international system and the photometric dimensions again into unison. This matter had been taken up in the year 1910 in the United States by the Illuminating Engineering Society, under the Presidency of Dr. Alex. C. Humphreys. A Special Sub-Committee for Photometric Units, consisting of Mr. Sharp (President), M. Blondel, Messrs. Kenelly, Nichols, and Rosa, have worked out a series of definitions which are given in the table attached to the report of the Illuminating Engineering Society in November, 1910.

These definitions deviate very little from those which had been formerly adopted at Vienna. The centimetre has been preferred to the metre as a unit of length in order to make the system more universally international in character, as the Anglo-Saxon countries have not yet adopted the metric system but only the c.g.s. system. On the other hand, the international candle has been adopted as the unit. The definition of specific radiation which M. Blondel had brought forward at Geneva, but which was not adopted there, has been reinstated. Practice has shown that this specific radiation is quite usable. Finally the introduction of the centimetre as the unit of length has led to the lux, or candle-metre, giving place to the lumen per square centimetre, as a unit of illumination. This unit has the advantage that it carries its own definition with it.

Pennsylvania Electric Association

At the fourth annual convention of the association Mr. C. E. Stephens presented a paper on "Ornamental Street Lighting," in which he went briefly over the entire subject, discussing the relative merits and demerits of the several types of lamps and installations for this purpose. In summing up he emphasized the fact that no one lamp or system was equally suited for all purposes, and that local conditions should be carefully considered in determining the system to be installed. The central station should always insist upon superior street illumination, and lead rather than follow in promoting it. To this end it should co-operate with the manufacturers of luminants and accessories in educating the public to an appreciation of what constitutes good street lighting.

American Items

Electric Signs in Milwaukee; *Electrical World,* August 26.

Indirect Lighting of an Arched Church Interior; *Electrical World,* August 26.

Downtown Arc Lighting of Philadelphia; *Electrical World,* September 2.

A short illustrated article on the twin arc ornamental street lighting throughout the business section of Philadelphia.

Observations on the Effect of the Light of the Mercury Vapor Light on the Eye, *by* Charles H. Williams, M.D.; *Electrical World,* September 2.

The investigation consisted in the examination of twenty-eight cases of persons who had worked under the Cooper-Hewitt light under different conditions, who are grouped by Dr. Williams as follows:

1. Eight cases of men who worked all day under unusual conditions of exposure to the light.

2. Twelve cases of draughtsmen who worked part of the time by daylight and part under the lamp.

3. Six cases of garage employees who worked at night with the lamp for their light.

4. Two cases of women who worked all day with the light in a photographic printing room.

The examination consisted of tests of the acuteness of vision in each eye separately, and an examination of the eye for errors of refraction and pathological symptoms. The first group consisted principally of men who have worked for a number of years in the test room of the Cooper-Hewitt Electric Company, where their eyes were exposed to the direct radiation of the tubes for the entire day. In all of these cases the eye was found to be normal and healthy with one exception, in which there was some nearsightedness of vision. The subjects were also tested for color vision, and while effects of color fatigue were clear they were of a temporary nature. The writer says that except for this temporary color fatigue none of the cases showed any effects whatever ascribable to the illumination under which they worked.

Operation of Series Alternating Current, by J. C. Lawlor; *Electrical World,* September 2.

The writer refers to the old rating of arc lamps, still found in many municipal contracts, in which they were designated as "2000 c. p. arc lights," and to the disputes and litigation that have arisen in the change to the enclosed arc lamp under these contracts. The article deals at length with the methods of inspecting and maintaining the series-alternating enclosed arc lamp to meet the requirements of municipal contracts which impose penalties for chortages and insufficient service.

Lighting of a Modern Barber Shop; *Electrical World,* September 2.

Magnetite Arc Versus Tungsten Posts; *Electrical World,* September 2.

Increasing Use of Flaming Arc Lamps; *Electrical World,* September 2.

Display Lighting in Denver; *Electrical World,* September 2.

Variations of Resistance with Temperature Shown by Nernst Glower, by Albert A. Somerville; *Electrical World,* September 9.

A report of some recent experiments carried out at Cornell University on the problem stated in the title.

Acuity in Monochromatic Light, by Dr. Louis Bell; *Electrical World,* September 9.

Dr. Bell notes the substantial agreement of the conclusions reached by Mr. Luckiesh in the experiments reported in his article of August 19, but calls the attention of the writer to an apparently careless assumption on the latter's part that Dr. Bell had assumed the mercury vapor lamp to be monochromatic, whereas in his article he had stated that "it is far from being monochromatic, but perhaps the closest approximation to monochromatism of any commercial luminant." Dr. Bell also reaffirms his belief in the reliability of the flicker photometer, and gives further reasons for holding this opinion.

The Campaign for Improved Street Lighting; *Electrical Review and Western Electrician,* September 16.

An illustrated article descriptive of the progress of the past few years for the movement for better street lighting.

Tungsten Light Installation on Michigan Boulevard, Chicago; *Electrical Review and Western Electrician,* September 16.

Electric Sign Lighting; *Electrical Review and Western Electrician,* September 16.

Illumination of the World's Largest Transmission Gear Factory, by Roscoe Scott; *Electrical Review and Western Electrician,* September 16.

An illustrated article on the illumination of the Brown-Lipe-Chapin Company factory, Syracuse, N. Y.

Making the Outside Bright, by Ralph Beman; *Electrical Review and Western Electrician,* September 16.

A short illustrated article on the use of the electric incandescent lamp for outdoor decorative effects.

Power House Lighting, by C. E. Clewell; *Electrical Journal,* September 16.

Like other contributions by this writer, the article is a careful analysis of the subject with a clear and concise treatment of each factor in the general problem. Photographs are reproduced showing several installations, together with diagrams showing the placing of lamps and illumination curves. The faults of old installations are described, as well as the advantages of new. An excellent general article which should be carefully read by central station engineers.

Modern Street Illumination—The Tungsten Lamp, by William Rawson Collier; *Electrical Record,* September.

An illustrated article describing a number of installations of ornamental street lighting throughout the country, with illustrations showing different types of standards.

The Use of the Triple Rating and Incandescent Lamps, by L. S. Twomey; *Journal of Electricity,* September 9.

Street Lighting in Reading, *Pa.*; *Selling Electricity,* September.

Residence Lighting Supplement; *Selling Electricity,* September.

Illumination and Wiring of a Locomotive Works; *Electrocraft,* September.

A short descriptive article giving the details of the lighting and wiring of the Davenport Locomotive Works, Davenport, Iowa.

Plain Talks on Illumination; *Electrocraft,* September.

This is the first of a series of unsigned articles, the purpose of which is to deal wih the principles of light and illumination in a scientific manner using a minimum of

mathematical and technical terms and formulæ. A table of intrinsic brilliancies is given, and the various units and terms are carefully defined and explained. The distribution curve is likewise carefully explained. The series is intended for the practical assistance of wiremen and electrical contractors, for which purpose it appears to be admirably adapted.

THE USE OF TUNGSTEN LAMPS IN SIGN AND OUTLINE LIGHTING, by W. B. Goudey; *Central Station,* September.

INCANDESCENT SEARCH LIGHTS; *Central Station,* September.

CHOOSING GLOBES; *Central Station,* September.

SINGLE UNIT LIGHTING DISPLAYING ELECTRIC LIGHT OF BILLIARD TABLES, by O. F. Anderson; *Progressive Age,* September 1.

LIGHTING TAILORS' CUTTING TABLE, by G. W. Riley; *Progressive Age,* September 1.

ARE WE ASLEEP AT THE SWITCH? by F. B. Anderson; *Progressive Age,* September 1.

LIGHTING BOWLING ALLEYS WITH REFLEX LAMPS, by Adolph M. Berg; *Progressive Age,* September 15.

A NARRATIVE CONCERNING THE LIGHTING OF THE GREAT SHOPS OF THE BROWN AND SHARPE MFG. CO., *American Gas Light Journal,* September 4.

INDIRECT LIGHTING, by Francis H. Gilpin; *American Gas Light Journal,* September 11.

A brief but excellent discussion of the disputed points in indirect lighting. The writer calls attention to the necessity of considering the visual, as well as the physical efficiency of a lighting system, and gives excellent general directions as to the proper use of indirect illumination. In point of physical efficiency the claim is made that indirect lighting with gas is as efficient as direct lighting by modern electric light sources.

SHOP LIGHTING CONSIDERATIONS, by F. B. Allen; *Engineering Record,* August 26.

LIGHTING OF THE OFFICE BUILDING, by Roscoe Scott; *Building Management,* September.

A short illustrated article on several methods of lighting passenger elevators.

ATTRACTING TENANTS BY SCIENTIFIC LIGHTING; *Building Management,* September.

Editorials

LUMINOUS EFFICIENCY; *Electrical World,* August 26.

THE NATURE OF LIGHT ACTION ON SELENIUM; *Electrical World,* August 26.

FOUR YEARS OF THE TUNGSTEN LAMP; *Electrical World,* September 2.

STANDARDS OF LIGHT AND THEIR APPLICATION; *Engineering Record,* September 2.

SHADOWLESS ILLUMINATION; *Electrical World,* September 2.

THE PHYSIOLOGICAL EFFECTS OF THE MERCURY ARC; *Electrical World,* September 2.

THE CAMPAIGN FOR IMPROVED STREET LIGHTING; *Electrical Review and Western Electrician,* September 15.

GAUGING ILLUMINATION BY PHOTOGRAPHS; *Electrical Journal,* September.

CHEAPER LIGHTING BY CENTRAL STATIONS; *Central Station,* September.

RATING OF INCANDESCENT LAMPS; *Journal of Electricity,* September 9.

THE CONTRACTOR AS A SPECIALIST IN ILLUMINATION; *Electrocraft,* September.

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THE JOY OF DOING

Nature has implanted in sentient beings two motives for action—joy and fear. Upon these depend not only the development of the individual, but the very existence of the species. The actions inspired by joy lead to development and progress; those inspired by fear to weakness and retrogression. Joy conquers; fear shuns.

The normal human being rejoices in action and seeks creative work. To live in inaction and therefore upon the labor of others is an acquired and degraded taste, and any considerable existence of such a condition in society forebodes general disaster.

The golden age of every nation has been that period in which all worked according to their strength and gifts, and rejoiced in their labor. The pioneer, whether in the unsettled country or in the unexplored fields of science, feels a delight in living wholly unknown to those who follow in beaten paths. To create anew rather than to take from others—that is the true joy of doing.

There is this strange paradox in human happiness—that it is multiplied by dividing with others. To do for oneself is a satisfaction; to do for others at the same time multiplies this satisfaction into positive joy.

Nature has ordained that some individuals shall direct and control the labor of others, and this law extends to the human species. Rightly viewed, the leader or director of others has the greater opportunity for the joy of doing in proportion to the number whose labor he directs; he can multiply his own pleasure by furnishing conditions that they would not achieve by their unaided labor.

To see others working at creative labor within the proper limits of their strength and ability, and under conditions as favorable as possible to their welfare, and to know that their work is in some measure the result of one's own initiative, is the most joyous position in which man can be placed.

Of all conditions which conduce to the joy of doing, both physically and metaphysically, none is so far-reaching as light. And, like all right actions, this furnishing of light pays—not figuratively, but in real dollars and cents.

LET THERE BE MORE AND BETTER LIGHT.

E. L. Elliott.

The Lighting of the Hotel La Salle, Chicago

An Example of Illuminating Engineering from the Architect's Standpoint

No question affecting the general progress of illuminating engineering has been so much discussed as its relation to architecture and the architect. This discussion has at one time or another assumed every tone and attitude possible in argument. The illuminating engineer has accused the architect of gross lack of knowledge of the subject and abuse of its most elementary principles, to which the architect has either replied by demanding whence the illuminating engineer came by *his* superior knowledge, or has passed by the accusation in contemptuous silence. The architect has twitted the illuminating engineer with his total lack of appreciation of the artistic principles involved, and the engineer has retorted by pointing out the numerous practical blunders perpetrated by the architect; and so there has been crimination and recrimination which has ended in nothing more serious than each acquiring a higher degree of respect for the other, for there is no denying the fact that the accusations on both sides contain some measure of truth.

The work of the illuminating engineer has been frequently set forth in the description of installations that have been designed under his direction. Illuminometer measurements have been given showing the resulting illumination on the "working plane," the watts per foot-candle, and per lumen generated, and per lumen effective, and per square foot per foot-candle, and per everything else, with solemn accuracy, all of which has added to the "literature of the subject,"

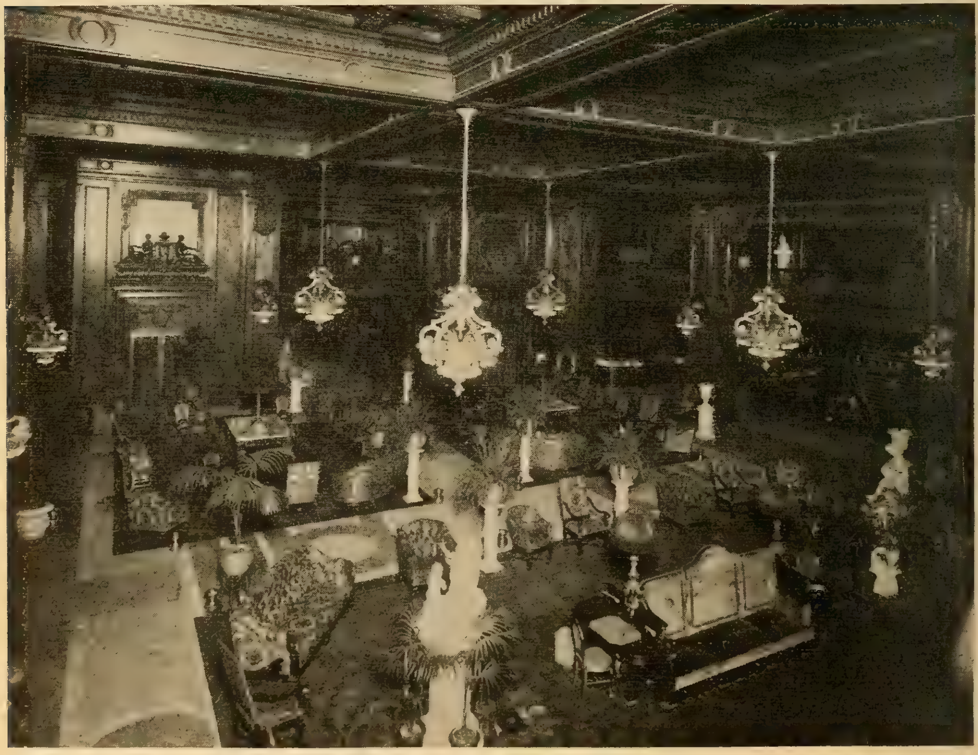


FIG. I.—THE LOBBY: THE FIXTURES ACCENTUATE THE GENERAL EFFECT OF GRANDEUR.

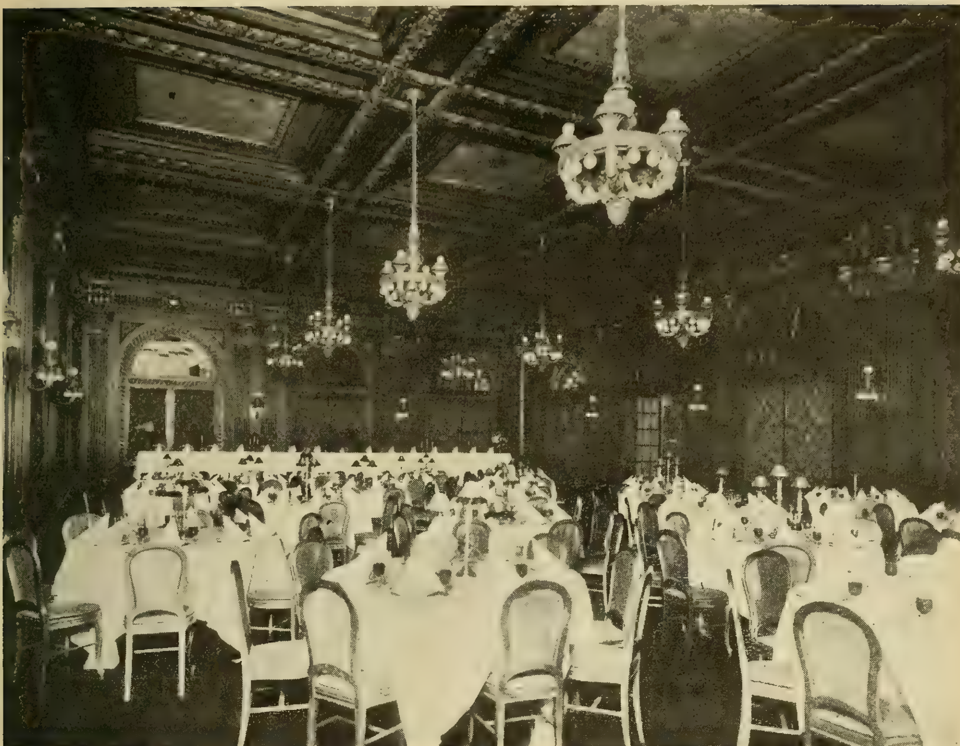


FIG. 2.—THE BANQUET ROOM: THE SPIRIT OF LOUIS XIV. ELECTRIFIED.

if not to the edification of the uninitiated. By way of variety, if nothing else, it may be interesting to examine a lighting installation in a modern public building of such size and cost as to afford full scope for the display of the architect's ability, from the viewpoint of the architect himself, so far as we are able to do so.

A modern first-class hotel involves a great variety of problems for the architect, which include many branches of engineering, as well as the art of building, and consequently afford him an opportunity to display his talents to the full. When completed the building stands as a practical embodiment of the architect's ideals. For what is praiseworthy the credit is his, and for what is blameworthy he cannot escape responsibility. Any building of this description may therefore be taken as an exposition of the architect's ideas of illumination. Even though he may have had the advice of a professional illuminating engineer, he must accept full responsibility for the final result.

The chief point at issue between the architect and the illuminating engineer, if the recorded discussions can be taken as evidence, is, at the last analysis, art versus utility. In buildings of this class the architect has insisted that the effect of the light in bringing out the architectural and decorative features takes precedence over physical or physiological efficiency, and that the harmony of the fixture design with the decorative scheme is of greater consequence than maximum production of illumination.

Let us now examine a number of the most prominent interior features of this building with a view to discovering how the architect has set about achieving the desired results from his viewpoint. We may begin with the lobby, or rotunda, a view of which is shown in Fig. 1. The keynote of this room, architecturally, is grandeur. Although the view is necessarily somewhat foreshortened from photographic necessities, the room is nevertheless of ample dimensions. It is the

FIG. 3.—THE MAIN DINING ROOM: A TWENTIETH CENTURY VERSION OF SEVENTEENTH CENTURY LIGHTING.

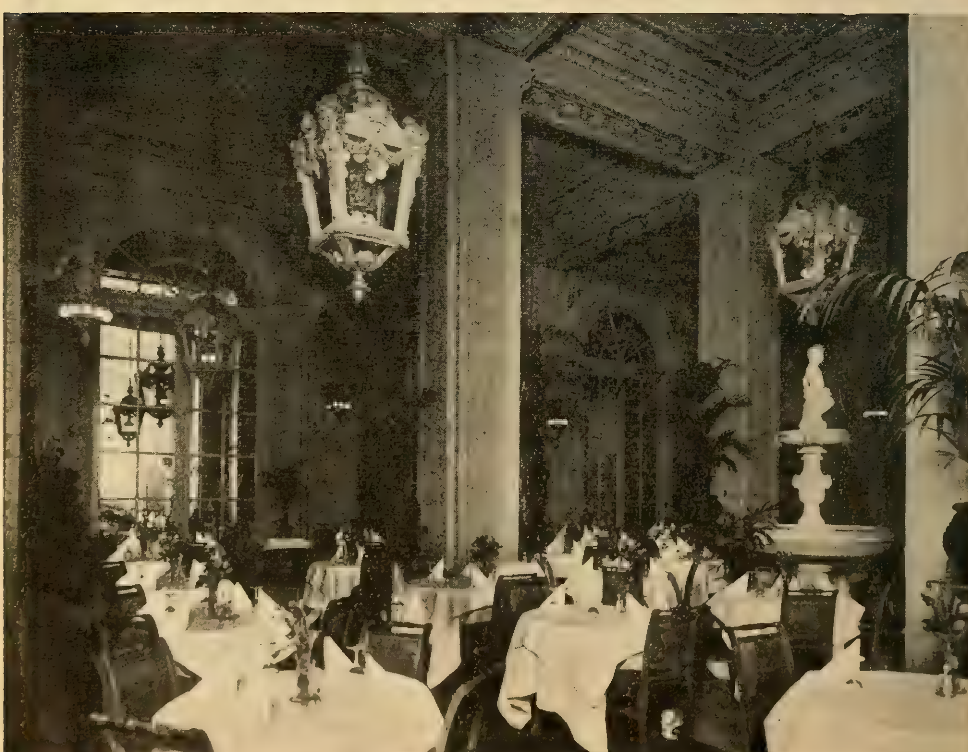


FIG. 4.—A CORNER IN THE CAFÉ: OUT-LOUISING THE LOUIS'.

FIG. 5.—ONE OF THE CAFÉS: A MODERN INSTANCE OF ELECTRIC LIGHTING.

height of two ordinary stories, a gallery or mezzanine floor opening around three sides. The interior finish, including the ceiling, is of dark brown wood, richly ornamented with carving. The carpets are dark green. The lighting, which is wholly artificial, is by massive chandeliers and side brackets. These fixtures suggest the Louis XIV. period of decoration; the massive crown-shaped structure is in dull gold, profusely carved, and supports a double circle of round frosted incandescent lamps. The side brackets are practically small chandeliers supported from sufficiently strong projecting arms. The illumination is of very moderate intensity, probably about a foot-candle. The frosting of the lamp bulbs removes any serious glare. The chandeliers are suspended some distance from the ceiling with chains, and are conspicuous items of furniture, and are so treated. They are clearly intended to add to the general effect of grandeur which is manifested in the architectural proportions, the quality of materials used, and the massiveness of decoration. The installation here is doubtless considered satisfactory from the architect's standpoint. The question now is, "How would an illuminating engineer have handled this problem?" As the old-time orator would say, "we pause for a reply."

From this we may enter the banquet room, shown in Fig. 2. Grandeur and elegance are again the prevailing motives. The finish is again dark, displaying touches of rich color and gilding. The same general method of lighting is used; massive metal chandeliers are suspended from the ceiling, equipped with a circle of pendant round frosted lamps surmounted with four in the upright position. Side brackets similarly equipped are placed between the pilasters. The upright lamps are evidently intended to prevent sharp shadows on the ceiling. Candelabra with real candles are used on the

tables. The lighting fixtures are again treated as important features in the decorative scheme, the motive of grandeur being evident in the enormous excess of metal displayed above the mere engineering requirements. There would seem to be no question as to the sufficiency of the illumination provided, nor is there any opportunity for serious criticism in point of physical efficiency. The round frosted lamps give an almost spherical distribution, but with side walls and ceilings distinctly dark in tone, and so richly decorated as to demand the attention of the observer, such a distribution is essential. In fact, the illuminating engineer would probably rather criticise the lack of more complete diffusion and modification of the light than inefficiency. The critic who was "nothing but a d—— engineer" might be inclined to stand from under so massive a piece of metal supported only by a small twisted cord, but this of course would only show his ignorance of the value of "historic feeling," and a reference to the use of this device in the candle-holders used by the "Grand Monarch" of France would refute his impious suggestion. When a man pays $10 for a dinner he is entitled to rest his eye on all the metal that the traffic will stand.

A view of the main dining-room is shown in Fig. 3. The architect has here made a definite effort to reproduce the magnificence of interior decoration and furnishings of the reign of Louis XIV. As a matter of fact, he has undoubtedly considerably outstripped that extravagant monarch. Modern public buildings make the famous historic palaces look cheap and tawdry by comparison, so far as construction and decoration are concerned. Where they used painted wood, we use solid marble, alabaster, or bronze; and our modern steel construction has made interior dimensions possible that were out of the question in the days of wood and

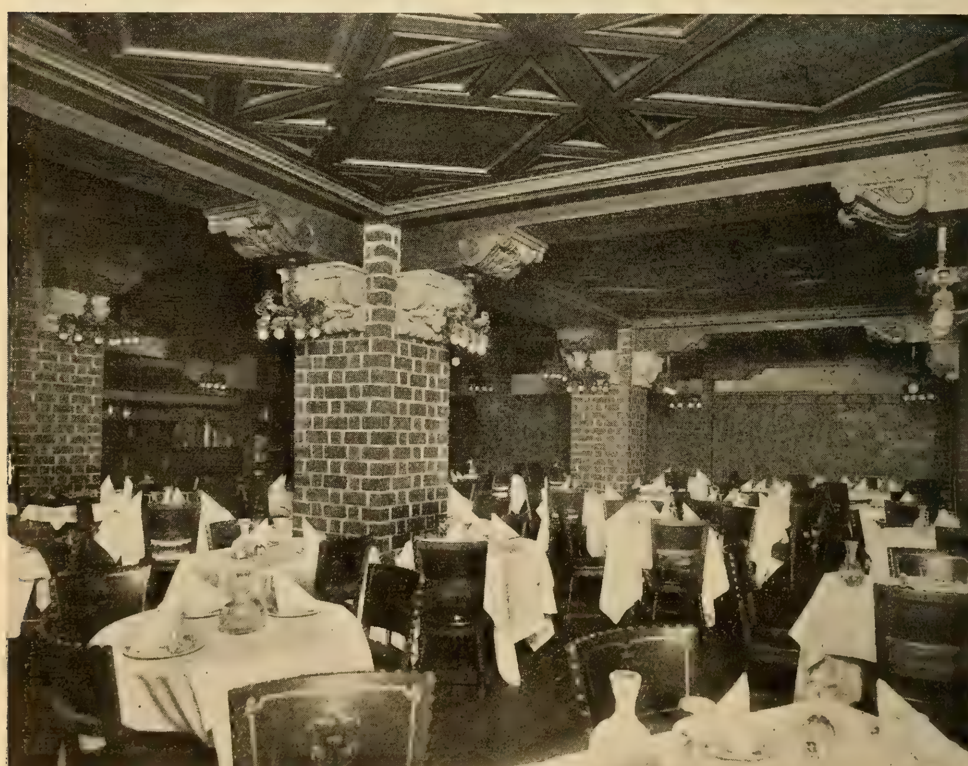


FIG. 6.—A CORNER OF THE GRILL ROOM: A NEW LAMP IN AN OLD SETTING.

stone. The one thing that we do not seem to be able to surpass is the motives of design used in the decoration and furnishing. Just why this should be so it is hard to say, but the fact remains that we are still generally contented to imitate the older models over and over again. As a piece of magnificent imitation this room must undoubtedly be considered a complete success. The lighting fixtures themselves follow closely the models furnished by the French designers of the period referred to. There is an abundant use of gilt bronze profusely sculptured, with the addition of the crystal prisms and pendants, which were features of the time-honored chandelier. The side brackets are notable for serving as flower vases as well as lighting fixtures—a unique conception, but entirely legitimate, from the point of view. The resulting illumination is undoubtedly ample in quantity to satisfy the guests, but there is this discrepancy between the quality of the light furnished by this installation and that of the installations of which it is a frank imitation: presumably the lamps are of the new metallic filament type, which give out a light that is almost white, whereas the candle flame is decidedly mellow in tone. The advantage in this case is with the original light-source, and the lady patrons will undoubtedly side with the writer in suggesting that some method of reproducing the quality of the old-time illumination will be found quite as essential as simply following the motives of fixture design.

Fig. 4 is a corner of the café. The interior finish here is a strictly modern adaptation of the classic, terra cotta being the material used. In the fixture design, however, the French motive has been strictly adhered to, ponderous lanterns being suspended from the center of each ceiling panel, with equally massive side brackets on the pilasters. Evidently a subdued illumination was intended in this case. A first impression is that these lanterns have been considerably overdone in weight and elaboration of detail in decoration, especially in view of the simplicity of the wall and ceiling treatment. Pursuing the critical study, the question will arise as to the justification for a lantern in an interior that is entirely protected from outside air. We might stretch the imagination to admit the usefulness of a lantern in a lobby or entrance, where we might conceive drafts of air sufficient to affect the very sensitive flame of a candle; but why an incandescent electric lamp, which is absolutely immune to outside atmospheric conditions, should be inclosed in a glass case is beyond the solution of the ordinary man.

A section in another of the cafés is shown in Fig. 5. The decorative treatment here is likewise distinctly modern, the material being quartered oak, given a soft and pleasing tint by chemical treatment. The lighting fixtures are likewise of modern design, though they somewhat suggest the furnishings of the old baronial halls. The electric lamp is used in its naked state, without any attempt at concealment or imitation. As an example of simplicity in motive and harmony of design this interior should satisfy the artistic taste of those who incline to repose rather than magnificence in architecture and decoration.

In Fig. 6 we have a view in the grill room. As usual in this class of interior there is an effort to give an air of antiquity to the surroundings. The exaggerated plane-marks on the cabinet ceiling and supporting beams, and the exposed brick of the walls and supporting piers carry out this idea. The lighting is entirely by brackets suspended from the capitals of the piers. The fixtures are in imitation of the wrought metal work of mediæval times. With their location, however, there may be some dissenting opinions. Why should they not have been placed in the angles between the decorative brackets, where they would have obscured nothing but the brick, instead of in front, where they hide the rather elaborate carving?

If none of these public dining rooms please your fancy you may have a private dining room, such as is shown in Fig. 7, in which case you will sit beneath a chandelier of French motive with lamps surrounded with prisms; you will also have to face side brackets similarly equipped, and unless your eyes are strong and without refractive errors you will more than

FIG. 7.—A PRIVATE DINING ROOM: SIMPLICITY AND BRILLIANCY IN EFFECT.

likely find youself blinking at these side brackets before you have been long seated at the table. Doubtless, however, these can be turned out without unduly obscuring the table.

A view in the upper corridor is shown in Fig. 8. The wall treatment here is in cabinet work with modern adaptation of French renaissance. The lighting is by ceiling fixtures of the mushroom type, a form much affected by some of the Eastern manufacturers. While it strikes the uninitiated as somewhat overdone in point of massiveness in proportion to the lamps which it supports, it is nevertheless in general harmony with its surroundings, and furnishes a sufficient amount of illumination reasonably free from glare.

In Fig. 9 we have a view of the reception room. As the ceilings are low the illumination is principally by what are commonly called ceiling bowls. In this case the bowl itself, which is of cut glass, is surrounded with frosted lamps. The metal work is made to harmonize with the general scheme of decoration. In addition side brackets are provided equipped with that curious anomaly in lighting, the imitation candle surmounted by a round frosted lamp.

Lastly, the reader may turn to the front cover, where is shown a view in the ballroom. A truly magnificent interior this, and one which, if it had existed in the period from which its decorative scheme is taken, would have been one of the wonders of the world. The chandeliers here are particularly massive, as necessitated by the dimensions and character of the room, and the side brackets are in keeping with the chandeliers. As a piece of architectural illumination in which general effect is paramount this would seem to be one of the most successful installations to be found. The central chandeliers add to the perspective without unduly obscuring any of the detail of ceiling or side walls, a result due largely to the tunnel vaulting of the ceiling. The same general remark is true of the side brackets. The propor-

FIG. 8.—AN UPPER CORRIDOR: UNOBTRUSIVE AND INVITING.

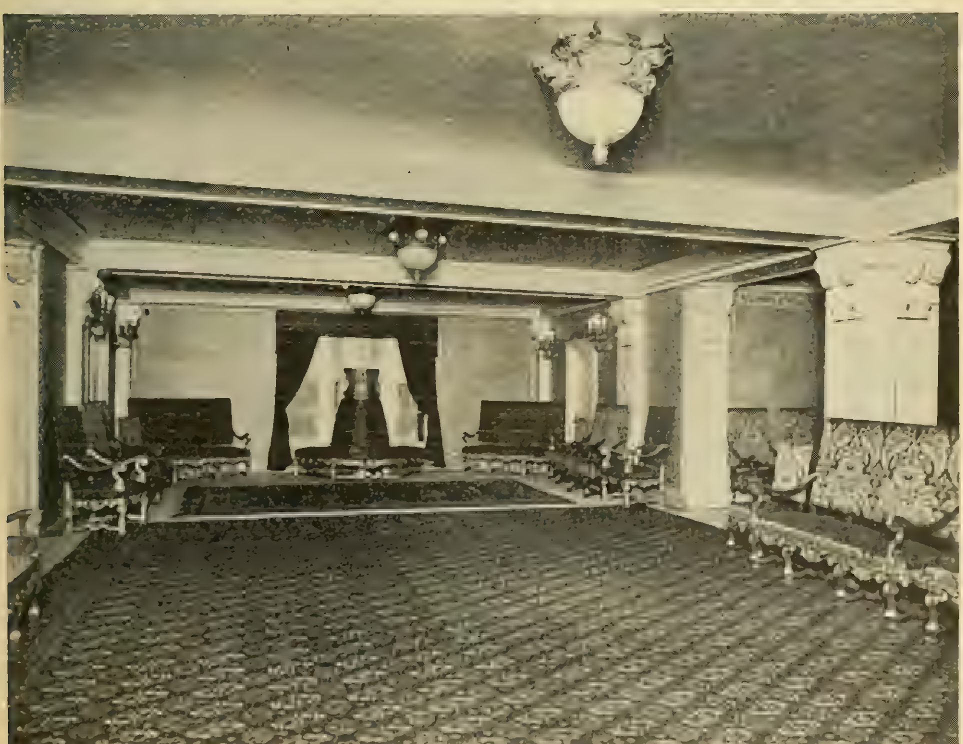


FIG. 9.—RECEPTION ROOM: SUGGESTING ELEGANT REPOSE.

tions of the fixtures are well balanced, and the brilliancy, aided by the profuse use of glass prisms, is quite in keeping with the purposes for which the room is intended. Possibly the lamps may need some toning down in color, but this can be easily accomplished. It is an example of brilliant lighting where brilliancy is required, produced with lighting fixtures in strict harmony with both the spirit of decoration and the architectural treatment.

Such, then, is the result of illumination as practiced by the architect and interior decorator. Is it on the whole good or bad? The only authoritative answer to that question must come from those who make use of the rooms lighted. Had an illuminating engineer laid out the installation what would he have done differently? Is there a practicing illuminating engineer who would like to take his chances on improving the lighting as shown, or of designing a better installation for another case of similar character? If so, let him now speak, or forever hold his peace.

An Appreciation of White Way Lighting

The West is a country of enthusiasm. This is a result of the necessity for doing things. In the East the great original work of clearing and settling the country was done by those who have already passed away, leaving their successors in the calm and often idle and lifeless enjoyment of the results of strenuous work of former days. In the West there is still the joy of doing, and right joyfully is the work done.

Here, for example, is the little city of Pine Bluff, Ark., which has a population of 25,000—a modest number compared

FIG. 1.—THE NEW ORNAMENTAL LIGHTING FIXTURES AT PINE BLUFF, ARK.

FIG. 2.—THE LIGHTING COMPANY'S FLOAT ON "WHITE WAY DAY."

with the great centres of trade. But it believes in doing things and getting all the enjoyment possible out of the doing. "If better public lighting is a good thing, then let us have it, and rejoice in its possession," is their spirit. There has recently been installed in this city a very complete White Way system, and the final putting of the installation into service was made the occasion of a general celebration and rejoicing. The importance of the event is well indicated by the prominence of the account in the local daily, which is set double column in the leading position in the paper. The headlines indicate the nature of the celebration and the interest manifested by the citizens:

WHITE WAY DAY SUCCESS; THOUSANDS MAKE MERRY

Great White Way Opened Under Most Auspicious Conditions—Parade Fitting Finale to a Day of Many Spectacular Features

THE DISPLAYS WERE VERY ELABORATE

Mayor Jordan Delivers Welcome Address and Pressed Button that Turned Night Into Day—Many Floats Representing Pine Bluff Business Houses and Industrial Plants in Procession

The following more detailed account of the installation is from a local correspondent:

The Pine Bluff Corporation at Pine Bluff, Ark., of which Byron C. Fowles, ex-president of the Arkansas Association of Public Utility Operators, is general manager, and Minor Q. Woodard is manager of New Business Department, have recently installed there the most complete "White Way" in the South.

The system extends through the three principal business streets of the city, which has a population of 25,000, the posts numbering 150, covering fourteen squares. The posts are of a simple design, constructed along modest lines that any small city can easily afford. Four sixteen-inch globes are mounted on iron pipe brackets, supported by iron pipe posts. They are set firmly in concrete three feet bury, and cost complete $24.00.

The plan of installing and operating the

"White Way" was worked out in an original manner and consists of a scheme whereby the merchant pays $5.00 per month for one year, at the end of which time the post becomes the property of the merchant; after first year he pays the company $3.00 per month per pole for the lighting and upkeep of 4-60 watt Mazda lamps. Number of hours burning being from dusk to eleven o'clock week nights and twelve o'clock Saturday nights, controlled from power stations.

In the campaign the Pine Bluff Corporation had the support of the local press from two papers, receiving in nine weeks 79 front page write-ups and 110 editorials. The Board of Trade co-operated in the campaign, and the grand opening, which consisted of eight aeroplane flights by Brindley and Heth, of the Americal Aviators, Inc., in two Wright bi-planes, to the delight of the crowd of 30,000 from all over southeast Arkansas.

At night an industrial and floral parade started at 7.30 p.m., when the Mayor threw the switch which lights the "Great White Way." The parade consisted of 136 decorated floats and autos and lasted two hours and forty-five minutes.

The Pine Bluff Corporation and the Pine City Electric Co., leading electrical contractor, joined in preparing an expensive illuminated float, claimed to be the largest of its kind ever built and lighted by storage batteries. The current was taken from sixty Exide batteries, which gave a no-load voltage of 130, which distributed to 262 5-W 12-V Mazda sign lamps, 8 250-W 110-V lamps, 16 100-W 110-V lamps, 10 60-W 110-V lamps, 24 40-W 110-V lamps, and about two K.W. in appliances of various kinds. Nine people were on the float demonstrating the uses of electric fans, sewing machines, motors, percolators, chafing dishes, curling iron heaters, fans, toasters, etc. The float was 24 x 11 and ten feet high, made of eight colonial columns and arches, with a color scheme of white. The publicity received during the campaign has already turned in much new business in the residence and business section, consisting of lighting and power, and has formed an exalted public feeling toward the company.

As an example of legitimate enterprise and co-operation between a Public Service Corporation and the leading citizens of a town, this is an example that will be hard to beat.

Artificial Lighting of Hospitals

By Charles W. Hastings.

In the field of illumination perhaps no section deserves more consideration than hospital lighting; quite recently Mr. John Darch, a member of council of the Illuminating Engineering Society (London), read a valuable paper upon the subject before the Royal Sanitary Institute.

In the lighting of public buildings, and particularly hospitals, in London and other large cities there is a trade uniformity in the matter of fittings, etc. There is generally the ordinary 10-inch opal shade hung from a pendant or insulated cord and this class of fitting does duty in consulting room, operating theater, corridor, kitchen, etc. Mr. Darch says of it: "The shade affords no protection to the eyes, and is particularly detrimental to the comfort of both patient and nurse, and injurious to the eyesight."

Another "detrimental" is the swan-neck bracket with a shade that shades nothing. Such brackets are to be found in many hospitals (see Fig. 1) causing the patient a maddening discomfort, the point of light having a fascination for the eye and a most unnerving effect upon the patient.

In dealing with the question of the luminant Mr. Darch said: "It is not so much of a question of gas versus electric light or, in fact, any other illuminant, as the application of the science of illumination which should determine the position of units of light when they are arranged for the illumination of the room. Whatever the luminant employed it should now be possible with the help of the illuminating engineer to successfully and economically illuminate every department of a hospital.

"The evils of glare must be avoided, and especially in wards where the patients are necessarily in a recumbent position. No units should be fixed in such a position as permits the patient to see the naked light, nor is it desirable to shade the light and so lose a large proportion of its light-giving capability. The position of each unit or group of units must provide against the evils of excessive brilliancy, of violent contrasts of light and shade, of

heat rays and actinism, at the same time the light should be sufficient to avoid eye-strain, a condition which might prove of great trouble to the patient. It must be remembered in hospital lighting, just as much as general illumination, that the value depends, not on the amount of light that is shed throughout a room but largely on that which is reflected from visible objects. Dark colors absorb light and are therefore wasteful; matt white ceilings, cornices and friezes, pale neutral tinted walls and slightly darker shades will be the best aids to effective illumination."

THE HOSPITAL WARD.

Dealing with the "Hospital Ward" Mr. Darch writes upon the assumption that the average ward unit may be represented by, say 40 beds. These require (1) general and (2) local illumination. The general lighting, he considers, need not be more than sufficient to see clearly about the ward, and suggests 0.5 foot-candle. No sources of light nor illuminated surfaces exceeding 0.1 candle-power per square inch (14 c.p. per square foot) should be exposed to either patient's or nurse's eyes. In this connection he mentions the intrinsic value of the following illuminants:

	C.P. per square inch.
Gas mantle...........	30
Acetylene flame........	40
Carbon filament........	400
Metal filament.........	1000

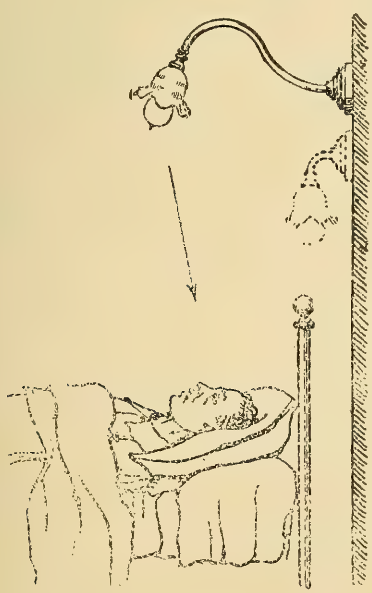


FIG. 1.—A COMMON TYPE OF FIXTURE USED FOR HOSPITAL ILLUMINATION.

Direct illumination, useful enough in the lofty out-patients' hall or elsewhere, is quite unsuited for the requirements of a hospital ward. Direct-lighting lamps may be used if provided with proper shades. Glass shades and all transparencies are, Mr. Darch says, inadmissible; even partial translucency should not exceed the limit of brightness that he names. They should also effectually screen the eyes without materially darkening the room. Such a shade is shown in Fig. 2. It is usually made of semi-opaque material, and is so adjusted that it completely illuminates both ceilings and walls, but at the same time the light is screened off from the eyes in all their normal positions. If bracket lights are used a half circle shade can be readily adapted. Ceiling lights can be shaded in the same manner, and the point of light protected so as not to attract the patient's eyes, the light striking upwards and being reflected back into the room from the ceiling and walls.

Indirect lighting by means of inverted electric arc lamps, will, Mr. Darch considers, serve well in many parts of a hospital, but they would be too dazzling for patients who have to lie continuously on their backs; a good effect may be obtained by indirect lighting with metal filament lamps placed inside a shade or metal bowl or dish, enamelled white on the inside. This should be hung as low as convenient; the lamp, however, should not be placed too low in the bowl.

In most hospital wards it is usual to keep a light all night; such night lights may well be a 2 c.p. filament lamp carefully shaded, or perhaps a better arrangement would be indirect lighting by means of an 8 c.p. lamp fitted in a small bowl as already described.

Local lighting should be carefully considered, such, for instance, as the tables of sisters in charge and the nurses. Perhaps the best method is to use a well

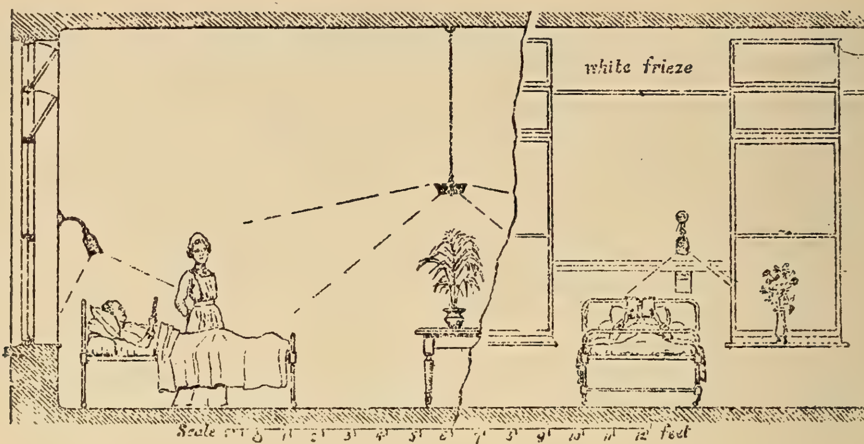


FIG. 2.

shaded lamp adjustable as to height so that the desired intensity and position may be obtained. A comfortable illumination for reading may be fixed at 4 foot-candles, but as both sisters and nurses have many occupations that require a good light it would perhaps be better to use lamps giving an illumination of 10 foot-candles. The lamp may be conveniently fitted in a metal or porcelain shell; if the latter a dark green back with opal inner lining should be entirely successful.

Patient's lights are best placed at the head of each bed; the point of light should not be within the range of the patient's eyes, and sufficiently high not to radiate heat on the patient's head; an illumination of 4 foot-candles will be quite sufficient for any ordinary purposes. In some wards it is customary to have a plug conveniently placed at the bedside so that a more powerful standard or portable lamp may be fitted should such be required to assist medical examination of the patient, etc.

The Operating Theater.

The operating theater needs to be well illuminated; light should be general throughout the building, but it may be advantageous to diffuse it. The ceilings and walls should be completely reflective and advantages would accrue if they were covered with white glazed tiles, although in these days a very fine reflective service may be obtained from plaster or Parian cement. If relief be required a soft gray tint might with advantage be used for the dado.

In the illumination of the operating table the light should approximate in color, diffusion and intensity to broad daylight; overhead heat should be avoided. The fittings and glassware employed should be plain, smooth, and easily cleaned. It is of paramount importance that the lights should not be clustered together, and so form heavy shadows, nor should they be fixed directly over the table; in such position the shadows thrown by the operator's head and hands would be very disconcerting and might necessitate frequent moving of the table.

Upon this point Mr. Darch says: "Every hospital has its own pattern of operating light—scarcely two alike—while many of them are curiously contrived. The following may be taken as typical of the more general arrangements in use:

1. One or more plain shade pendants of the common type, sometimes with a counterweight and pully for raising and lowering the lamp.

2. A cluster of from two to twenty glow lamps under a large opal shade.

3. Rectangular trough 4 feet long, with opal sides, full of lamps and sometimes with a sheet of opal glass underneath; this, it is said, gives an excellent light, but the heat is intolerable.

4. A four or six light electrolier, each arm with a separate lamp and opal or aluminum bell shades.

The lamps, which are usually of the glow type, may have carbon or metal filaments, and either depend from the ceiling or from the end of long swing brackets."

In the London Hospital, one of the largest and most complete in Great Britain, the operating room is fitted with Marshall's operating light, as shown in Fig. 3. This consists of a fixed central 100 c.p. lamp fitted in a large opal reflector. The pendant has four hinged arms each with a 60 c.p. Nernst lamp fixed in a condenser tube, which may be set at any angle and the light rays directed to any desired spot.

In the lighting of hospitals, and particularly the operating theater, direct lighting with arc lamps is out of the question on account of the heavy shadows, and often very intermittent light. Mr. Darch thinks that a splendid direct illumination may be obtained from white flame arc lamps provided they can be fixed high up in the theater; in the center of a skylight, for instance, the flame arcs will give an illumination of remarkably high efficiency and most of the light will be thrown downward. Indirect arc lighting can be arranged, and for the purpose it is suggested that four 10-amp. open arcs should be used. If these are properly placed and the light reflected directly on to a specially prepared white ceiling the result would be a brilliant illumination with all the advantages of daylight.

The foregoing is only a summary with some comment of the paper read by Mr. Darch. Very few papers of this character have been read before scientific societies, and the subject is so full of interest and possibilities to illuminating engineers that I felt the editor would permit me to draw the attention of his readers to what was being done on this side in the hope that it might possibly open up a new field of work on your side.

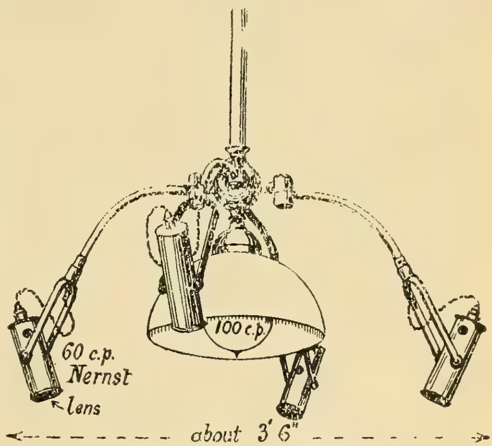


FIG. 3.—MARSHALL'S OPERATING ROOM FIXTURE.

The Selection of Factors of Safety for the Designing of Lighting Systems

By R. F. Pierce.

In the design of lighting systems, naturally the first step is to determine the proper rating for the unit under consideration. Inasmuch as it is necessary for the user of light to obtain the calculated amount of illumination during that portion of time in which the lamp is operating at its minimum candle-power, and all light in excess of this minimum is practically wasted, the minimum results obtained under laboratory conditions furnish the proper basis for a candle-power rating.

It will be contended, with reference to incandescent electric lamps especially, that not all lamps will be replaced simultaneously in practice, and that results corresponding to the minimum candle-power of a single unit will not coincide with the minimum illumination obtained in practice. Inasmuch, however, as in the interests of economy, it is considered good practice to replace lamps at a definite period,

regardless of whether or not they are burned out, it is fair to assume that this rating corresponds to the best practice under ideal service conditions at the relative lamp and current costs which determine the useful life as ending with 80 per cent. depreciation in candle-power. As the total amount of energy consumed during the life of the lamp represents the energy required to secure the minimum illumination, the proper efficiency rating is found by dividing the minimum total lumens or M. S. C. P. during useful life by the average energy consumption during the same period, both, of course, referred to laboratory conditions. Inasmuch as exactness is highly necessary in fixing a lamp rating, and exact and invariable results may only be obtained from laboratory tests under satisfied fixed conditions, this method of rating is entirely justified.

To obtain a practical rating, however, it is necessary to reduce the laboratory rating by a factor representing the effects of unavoidable discrepancies between laboratory and service conditions. This factor should not, however, contain the effects of any variations from laboratory conditions which are under the control of the user or the company supplying the service and energy. Such discrepancies are chargeable to the user and the company, and not to the lighting unit or its manufacturer. As it is entirely possible, though seldom practicable, for the public utility corporation to maintain electric pressure and gas pressure and quality equivalent to those under which laboratory tests are made, it is entirely proper to exclude the effects of variations due to these factors from the practical rating of the lamp. As the user may, but seldom does, maintain glassware at its initial efficiency, depreciation from this source is also properly excluded.

The allowance for variations or discrepancies in voltage, gas pressure or quality and condition of glassware should be made by means of a factor of safety applied in the design of the installation, and have no part in the rating of the lighting unit itself.

The practical rating of the electric incandescent lamp may be properly regarded as identical with its laboratory rating. In using incandescent gas lamps, however, it is necessary to adjust the lamp in places by the eye alone, and this adjustment is somewhat below that obtained by the aid of the photometer, both in candle-power and efficiency, to an extent depending upon the skill of the person making the adjustment.

While it would be preferable for extreme exactness to make the practical rating of the gas lamp without reference to the adjustment factor and supply an additional correction with reference to the skill of the adjuster, whether a skilled fitter or an unskilled user, to obtain a final practical rating, the difficulties encountered by the gas companies in maintaining such factors for both their own fitters and their customers, make it desirable to apply a reduction factor representing the discrepancy between photometric adjustment and that by the average unskilled person. While this is really a factor of safety, it is desirable to separate it from the factor of safety proper.

The proper practical rating for an incandescent gas lamp, is therefore the minimum total lumens or M. S. C. P. during the useful life of the mantle, divided by the average input during the same period as obtained in the laboratory, decreased by an adjustment fitter representing the results obtained by a person of average skill.

Extensive tests indicate that the proper reduction factor for this purpose is about 15 per cent. Of course, only mantles of the best commercial quality should be considered, as such mantles are available to both the lamp user and the gas company, and their failure to take advantage of this fact is chargeable to them only.

The 100-watt drawn wire filament tungsten lamp, operated at top voltage depreciates 80 per cent. in candle-power during the useful life of 1,400 hours, and it thus appears reasonable to rate this unit at 531 lumens. During this period, the average input appears from published data to be about 98 per cent. of the initial, hence the efficiency rating at 5.42 lumens per watt.

With regard to gas lamps, when equipped with the best quality of commercial mantles, there is no mantle depreciation

requiring an allowance in fixing a practical rating, as first-class mantles undergo depreciation in neither candle-power nor efficiency under laboratory conditions, nor is there any evidence that any depreciation ascribable to mantle deterioration exists in practice. Such investigations as have been made indicate that lamps which show depreciation in practice may in nearly every case be brought back to within 5 per cent. of their full initial candle-power by proper cleaning, provided, of course, the mantles are of first-class quality and in suitable condition to remain in service. The initial performance of gas lamps in the laboratory, reduced by 15 per cent. to compensate for the adjustment by the average unskilled person, is therefore a fair indication of what may be expected under ideal service conditions, and it is with such conditions only that the rating of the lamp has to do.

In selecting a factor of safety in designing lighting installations, corrections for the effect of the following must be allowed:

With tungsten lamps, (a) operation other than assumed voltages, (b) accumulations of dust on globes and reflectors.

With incandescent gas lamps, (a) operation under other than assumed gas pressures and qualities, (b) accumulations of dust on cylinders and reflectors; (c) accumulations of dirt in the burner; (d) use of inferior mantles.

Regarding the possibility of tungsten lamps being operated at other than the assumed voltage, it must be considered that, on alternating current distribution especially, actual voltages may vary considerably from the nominal, not only over different portions of the distribution net work, but over different portions of the same house circuit and during different portions of the day. That portion of the factor of safety which depends upon voltage discrepancies will therefore vary according to local conditions and the extent to which these conditions are known to the designer. There is also a possibility that the customer may purchase lamps of improper voltage, through lack of information on this point. It is also a very common practice to operate lamps at the bottom rather than the top voltage, and this very frequently happens at the solicitation of the salesman, who is anxious to remove the complaints from early burn-outs.

Where local conditions are not thoroughly known, conservative engineers generally deduct from 25 to 35 per cent. to allow for the probable operation of lamps considerably below the rated voltages. In default of information as to the care that the glassware may be expected to receive, it is well to make liberal allowances for discrepancies from this source.

In a paper published in the Transactions of the Illuminating Engineering Society, November, 1909, by A. L. Eustice, depreciations running as high as 40 per cent. were noted, due to fouling of glassware only.

The depreciation of 40 per cent. was noted in a draughting room, lighted by 100-watt ball frosted lamps equipped with clear prismatic reflectors, a test being taken about six months after cleaning. The building was provided with forced and filtered ventilation.

A depreciation of 33 per cent. was noted in a café on a 40-watt ball frosted tungsten lamp equipped with clear prismatic reflectors, approximately eight weeks after cleaning.

In the last instance lamps of various voltages from 110 to 115, and some without voltage labels, were found in the sockets.

It would appear from the foregoing that a factor of safety of certainly not less than 30 per cent. should be used to allow for depreciation by dirty glassware alone, in all cases where the engineer has no assurance as to the sort of maintenance that may be expected.

In fixing factors of safety for use in designing gas lighting installations, it is well to consider that the lamps will be operated at the lowest figure in the pressure range as increases in the pressure (unlike increases in voltage as referred to electric lamps) do not decrease in the least the life of the mantle. Having obtained data on the laboratory performance of the lamp at a pressure equal to that represented by the bottom of the

pressure range to be anticipated in service, 15 per cent. should be deducted as an adjustment factor. By this means, the effects of pressure variations are at once eliminated in so far as the minimum illumination obtained is concerned. In allowing for depreciation by accumulations of dirt on the glassware and in the burner, it is necessary to consider whether or not the lamps are to be under maintenance by the gas company. If the lamps are to receive attention every ten days, which represents good maintenance practice, it is necessary to allow only 10 per cent. for depreciation in glassware and burner during this period, as the lamps will be brought back to full initial value after the attention of the fitter.

If the lamps are to be maintained by the customer, it is well to allow for about 35 per cent. in depreciation, due to the fouling of the glassware and burner under possible neglect by the customer.

The allowance of the maximum factor of safety should be made only in cases where the possibility of considerable abuse by the user exists.

Where the lamps are maintained by skilled and conscientious workmen, the 15 per cent. allowance for fitter's adjustment is entirely too high, and the allowance of 10 per cent. for depreciation from dirty glassware is, to say the least, conservative for a ten-day maintenance period.

Also, a properly maintained installation in the customer's hands will render a service closely approaching that under company maintenance.

In general it may be stated that proper attention by either gas or electric companies, or the proper education of their customers, will enable either to obtain service results so closely approximating laboratory results, that the factor of safety may be made nearly negligible. It is in either case really a "bad service" factor and as such will be found in average practice to be practically the same with either illuminant.

Extensive tests show that incandescent inverted gas lamps of first-class quality, burning 3 1-3 cu. ft. of water gas per hour, operating at 2½-in. pressure, will produce a total flux of about 812 lumens. Reducing this by 15 per cent. for the adjustment by a person of average skill gives 690 lumens as the practical rating for the unit. Manufacturers of gas lighting apparatus furnish correction factors for different pressures and gas qualities which should be applied to obtain the final practical rating under the conditions of service anticipated.

Lighting a Dairy Lunch Room

By J. P. Conroy.

It is said that illuminating engineering is, in general terms, providing the proper illumination to suit given conditions at the lowest cost. Manifestly, then, the first task of the illuminating engineer is to determine the conditions and the amount and quality of illumination which will best meet them.

When you go into a dairy lunch your object is very clearly defined in your own mind. You want something to eat; you want it quick; and you want it clean. You do not expect elegance or style. The one essential condition is cleanliness, in both fact and appearance. There must be a sanitary air about the whole place, an absence of odor of any kind, and an illumination that is bright and cheerful, and which carries with it a feeling that there is nothing to conceal and that everything will bear all the light that can be shed upon it.

As prices must be limited, it is especially necessary to produce such an illumination at a minimum of cost. These conditions point unmistakably to one system of lighting—namely, the modern inverted-mantle gas arc. In point of economy no argument need be given, as the gas arc is recognized as the leader in this respect. In point of quality of illumination it leaves nothing to be desired. The light is per-

FIG. I.—GAS ARC LAMP ILLUMINATION IN A LUNCH ROOM.

fectly steady, well diffused, and of a color just enough toned down from white to prevent harsh and distorted effects; while the lamps themselves, with their trim nickel-plated cases and pure white globes give just the idea of cleanliness and care that is produced by spotless table linen.

The illustration shows a dairy lunch in the busiest section of Forty-second Street between the Grand Central Terminal and Fifth Avenue. Unfortunately the photograph does not show the lamp itself, owing to halation, but the illumination of the room is well depicted, being uniform in intensity and free from objectionable shadows, while the general brightness is such as to give the room a decidedly inviting appearance.

Courtesy of the New York Edison Co.

FIG. I.—VIEW OF NEW YORK ELECTRICAL SHOW.

The New York Electrical Exposition

The New York "electric show," as it is familiarly called, is the first event of the kind to take place in the new Grand Central Palace, and occupies the first floor and galleries of the enormous new building erected over one block of the New York Central Railway yards. The word "palace" is not inappropriately used in this case. The structure is a magnificent piece of architecture, and furnishes a very marked contrast to the barn-like appearance of the Madison Square Garden, in which the shows have been previously held.

As there have been no startling new discoveries or inventions in electricity during the past year, it follows that there can be no sensationally new features at the show. The space, however, is filled with interesting exhibits showing the various applications of electricity to the needs of man. Of particular interest to the illuminating engineer are the displays of the manufacturers of lighting glassware, who are well represented.

The most conspicuous feature in these displays is the production of large pieces of translucent-glass for semi-indirect lighting, a system which seems destined to occupy a prominent place in domestic and commercial illumination of the better class. The several forms of electric arcs, which were so prominent a few years ago, are now conspicuous by their total absence. This, of course, simply means that they have become familiar objects and can no longer be classed as novelties.

Perhaps the magnificence of the new building may have something to do with it, but it seems to us that this is decidedly the most attractive electric show that has ever been produced in this city.

Eye Protection

By Hans K. Ritter.

Taking notice of the different forms of illumination at present in use I find that the ideal for full eye protection is not yet reached in illuminating engineering.

Many professors complain about their eyes, they need assistants to save them. Often a banker stops after working for a few minutes, his eyes are tired out. The clerk's and draftsman's eyes are running, and the workman is not able to accurately see his work. The main cause for all this is the dazzling illumination almost universally in use.

Just to show under what characteristics a modern illuminant should operate, I shall repeat the main principles.

There should be sufficient illumination.

Too much light should be avoided. The iris can contract and shade the eye only a certain amount, and it soon gets fatigued by the contraction necessary, when a strong light strikes it. The strong light striking the retina of the eye produces a strain, which is very detrimental, and, if continued, weakening for the eye.

Dazzling lights in the field of vision should be eliminated, as a picture of the light itself will be formed on the retina of the eye and other objects in comparison seem dim.

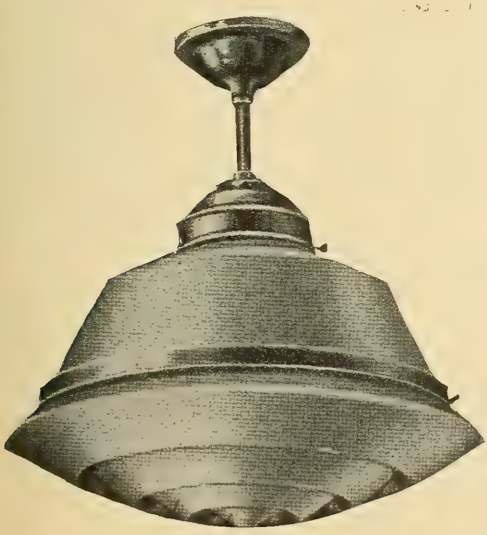


FIG. 1.

This is the reason we are unable to see past a bright light and why a bright light is so dazzling in the effects.

This means that we must keep the intrinsic brilliancy or the candle-power per square inch of surface as low as possible.

The eye ordinarily can withstand, without fatigue, a brilliancy of four to six candle-power per square inch of surface. The candle has, for instance, an intrinsic brilliancy of three to four: whereas the light emitted from one square inch of filament of incandescent lamps would be from 400 to 800 candle-power.

For this reason frosted bulbs are recommended by the lamp manufacturers, but this remedy cannot be said to fully cover this problem.

A frosted bulb lamp which may have a brilliancy up to 8 or 10 candle-power per square inch is still too bright to be left unscreened within the field of vision.

Incidentally, sand blasting the bulb tends to diminish the effective life of the lamp, reducing it to some degree and according to several observers, to a large extent. It is therefore better to use clear glass bulbs, screened by a diffusing outer envelope big enough to keep the intrinsic brilliancy down to 2 to 4 candle-power per square inch, or less.

Streaked light is bad, as the retina of the eye is unable to adjust itself to the streaks of different intensity.

Looking at the different installations in private houses, offices and factories, I find that to this last principle scarcely anybody pays enough attention, and it can be said, that perhaps more persons' eyes have been ruined by this than by any other cause named.

At present there are several methods developed to illuminate without showing the glaring lamp filaments; for instance, indirect illumination, but an investigation of this method soon shows that it can not

be generally adopted, as its efficiency, in most cases, is dependent on the preparation of ceilings and walls.

A direct illumination with similar effects to the foregoing, but at the same time applicable in nearly all installations, and having a very high efficiency, is invented by Mr. J. J. Ritter in Basle, Switzerland.

He made studies and tests, and after many trials found a diffusing envelope, which can be used as a screen under a high candle-power lamp. To enable the invention to be fully understood, I will describe it by reference to Fig. 1.

The improved shade comprises an upper reflector, and a lower glass distributor, provided with concentric corrugations, the latter is on one side of the crest, translucent (matt frosted, diamond pressed, etc.), and on the other side transparent.

This has the effect that the light rays which pass through the translucent portion of the distributor are diffused, whereas all reflected rays coming from the upper part go unobstructed through the transparent glass.

In this manner the light rays, which would otherwise fall direct on the eye, have their intense glare dulled, while the rays thrown back by the reflector, by reason of their indirect passage, are of less brilliance, and can penetrate uninfluenced.

By this means an excellent light is obtained as regards strength and eye protection.

The use of this patented arrangement, embodied in the reflector and in the diffusor described, is therefore both rational and hygienic. It reduces the intrinsic brilliancy to the required figure of two to four candle-power per square inch, without impairing the efficiency.

FIG. 2.

Illustrations show the commercial products of this invention, made by Messrs. Ritter and Uhlmann, Basle, Switzerland. Through the courtesy of this firm, I am able to re-produce these fixtures.

Illumination of Italian Religious Festivals

The Italians are a peculiarly light-hearted people. Those who judge of the race only by the newspaper accounts of Black Hand outrages and fatal vendettas will form an opinion as far as possible from the real truth. They are possessed with an innate sense of and appreciation for the picturesque and the spectacular, and their mercurial temperament fits them for an enjoyment of the artistic and lighter side of life that is not possessed by the grim Anglo-Saxon nature. There are many festivals in their religious calendar, a considerable number of which are in commemoration of historic characters, who are sainted in their eyes by reason of deeds of valor or piety.

In expressing their appreciation or

Courtesy of the New York Edison Co.
FIG. I.—ILLUMINATION IN DOWN TOWN "LITTLE ITALY," NEW YORK, AT FESTIVAL OF SAN ROCCO.

adoration of saintliness nothing is so fitting as light; as an emblem of thought, of purity and of constancy it has always occupied a chief place in the religious rites of all nations. The candle and the oil lamp were for ages used as votive offerings; but the Italian in America has become possessed of the spirit of modern progress, and is now quite content to utilize the electric lamp, with its infinitely greater possibilities for artistic and spectacular effects, in his festivals commemorating the heroes of his worship.

The festival of San Rocco was recently celebrated in this city in the chief Italian strongholds. San Rocco flourished in the thirteenth century, and was beatified for his heroism and self-sacrifice in caring for the victims of the plague which at that time ravaged southern Europe. In the downtown "Little Italy" an elaborate system of festoons of lamps was installed, a night view of which is shown in Fig. 1. In the illumination in the uptown colony, more than 10,000 electric lamps were used for the street illuminations during this festival. Besides the lighting there were street parades, church services, and band concerts.

So long as our new Italian neighbors show such evidences of assimilation as the use of electric light on the scale and for the purposes shown, we may readily quiet our fears concerning the comparatively few outbreaks of violence which, after all, are not strictly speaking Italian.

The Illuminating Engineering Society

Fifth Annual Convention

The annual convention of the Illuminating Engineering Society should be the most important event of the year in the field which illuminating engineering professes to occupy. There is at present but one organization in this field, and hence no division of interest and responsibility. If the Illuminating Engineering Society does not represent the science and profession with which it deals, then there is a serious discrepancy somewhere in its work. Its annual convention is the criterion by which both the work of the society, and the science and profession which it represents, will be judged by the public and by the other professions. Whether this convention adequately represents illuminating engineering is not for the public, but for those within the profession to judge.

It will be most instructive and helpful to discuss the convention from both viewpoints, looking at it with binocular vision, so to speak, which always gives the better perspective. Taking first the outsider's view, the number in attendance would be perhaps the first fact to be observed. The maximum registered attendance of members was 141, with sixty guests. Taken by itself this is not a large number of individuals; but when we remember that by far the larger majority of people, even yet, have never heard of illuminating engineers, the fact that 141 men, some coming from a distance of 1,500 miles, spend a week of time in a busiest season of the year is a phenomenon that would certainly attract attention, and impress the observer with the fact that the occasion which brought these men together must be of serious importance. If this observation led to a closer study of the event, it would be discovered that a goodly majority of the registered number were in attendance at the sessions, which were held twice a day, and that the interest manifested in the topics under discussion by those present was alert and sustained, with a general eagerness to take part in the deliberations. To the ordinary layman the large majority of papers would represent only a contribution to the unknown language of science, and their value would very likely be judged in the inverse ratio of their comprehensibility.

The social events of the programme would not be without interest. While naturally the larger part of the social programme was for the lady guests, providing for their diversion during the regular sessions, it is worthy of note that at none of the gatherings were the ladies excluded. At the two principal functions, the reception and dance on Monday evening and the banquet on Wednesday evening, there was everywhere in evidence keen enjoyment of the occasion, with the entire absence of any undue hilarity calculated to cause physical and mental reminiscences the next morning, a condition which unfortunately has not always maintained in the case of similar gatherings, especially those attended exclusively by mere men. Altogether the impression gained by the casual observer must have been of a dignified body of men collected together for the earnest consideration of serious subjects and purposes, and that their labors were interspersed with social amenities of a decidely cordial, but refined nature.

The Convention from the "Insiders'" Viewpoint.

Looking at the convention from the inside, i. e., from the viewpoint of a member of the society, the number in attendance must, all things considered, be deemed exceedingly satisfactory. While it numbered only about 12 per cent. of the total membership of the society, it included nearer 75 per cent. of the members that are actively engaged and interested in the scientific aspects of illuminating engineering. The proportion of attendance to registration was still more commendatory, and the interest in the papers and discussions was above criticism.

An analysis of the programme of papers and reports, however, may afford the most valuable key to the present status of illuminating engineering as gauged by the work of the society. There were fifteen papers presented, one stereopticon talk, and two committee reports, which may be classified as follows:

Subject.	Number of papers.	Pages.	Per cent. of total pages.
Illuminating glassware	3	92	39
Performance of light-sources	4	52	22
Photometry	3	36	15
Esthetics of illumination	1	14	6
Calculations	1	13	5½
Legal regulation	1	13	5½
Lighting systems	1	12	5
Advertising	1	4	2
Total	15	276	100

Illuminating Glassware.

The most conspicuous fact brought out in the above analysis is the large part which illuminating glassware plays in illuminating engineering, taking the convention papers as a criterion, the papers on this subject constituting 39 per cent. of the total printed matter. This would seem to corroborate the statement often made by architects and others that "illuminating engineering is the science of reflectors." Of course those who are conversant with the subject know that this is far from the truth; accessories for distributing or diffusing light taken altogether are by no means the largest factor in the general problem, and glassware only constitutes a part of such accessories. Furthermore, a perusal of the society proceedings would disclose the fact that this particular subject had been thrashed out several times over, and that nothing new, except in a purely commercial sense, was brought out in the whole 92 pages of matter presented. In fact, nothing essentially new has been brought out in lighting glassware since the commercial introduction of translucent glass of the moonstone type. Furthermore, it is the universal practice now among manufacturers to give distribution curves along with the illustrations of new patterns as fast as they are brought out, and this information is freely distributed in the form of bulletins. If there is any one subject which does not need investigation and exploitation by the society it is the question of lighting glassware. The manufacturers in this line were the first to take up the application of illuminating engineering to their wares, and are doing all that is required in this direction. Unless something distinctly new is produced, therefore, or some entirely different line of research developed, there is no further occasion for any extended discussion of this topic by the society.

Construction, Performance and Maintenance of Light-Sources.

In a number of papers presented the construction, performance and maintenance of light-sources has the lead, and is second in number of pages, although in this respect it reaches but little more than half that of lighting glassware. To the prominence of this subject no exception can be taken. The economics of illuminating engineering, which certainly rank as high as any division of the subject, should naturally have a corresponding place of importance in the work of the society. To be sure, a considerable portion of the papers on this subject dealt with physical theories and mechanical technology with which the illuminating engineer has only a general or secondary interest, but it is far better to err on the side of too extended infomation on this important subject than the reverse. All of the papers presented were thoroughly scientific, and were a substantial addition to the literature of the subject, giving as they did the results of careful investigations along lines hitherto unexplored.

Photometry.

Photometry comes next in the number of papers and number of pages, the latter constituting 15 per cent. of the total. This would probably be considered a fair measure of the relative importance of this subject to illuminating engineering. While the majority of engineers will perhaps never have occasion to make practical use of the technical details set forth in the papers, the subject is nevertheless fundamental, and any real contributions to the general knowledge of the problem are of value.

Methods of Calculation.

Methods of calculation, which have sometimes been sneeringly referred to by the outsider or would-be illuminating engineer, came in for only 5½ per cent. of the subject matter presented. This would indicate that the mathematical basis of the science has been pretty thoroughly established, and such in fact is the case. The one paper presented on this subject was an original and valuable contribution, setting forth a method by which some of the most important calculations can be carried out in a very simple manner without the use of higher mathematics.

Esthetics.

The relation of esthetics to illuminating engineering was represented by 6 per cent. of the literature. This was the admirable and original paper setting forth the results of a study of daylight illumination. It is one of the very few papers dealing with this subject from the experimental standpoint thus far contributed to the proceedings.

Legislative Regulation of Illumination.

The relation of illumination to factory inspection, or labor laws, as indicated by existing statutes, was set forth in a paper comprising 5½ per cent. of the total.

Lighting Systems.

On the subject of lighting systems, with particular reference to the physiological results of illumination obtained, there was but a single paper, constituting but 5 per cent. of the total. This is perhaps the most astonishing fact to illuminating engineers which is brought out by this analysis. A division of the subject by the average layman, as well as the professional illuminating engineer, would undoubtedly put this phase of the subject on a par with the economical side, and there are not a few who would give it considerable lead over that subject. The client of the illuminating engineer wants to know two things: First, what kind of a lighting system will enable him or his employees to see best to perform their various duties, and, second, what kind of lamps and accessories can be most economically used to produce such an installation. To these two main questions all others, though of importance, must be subsidiary. Furthermore, there is less positive knowledge upon this topic than upon any other with which illuminating engineering is dealing at the present time, and hence a greater necessity for study, investigation and report of results.

Advertising.

The use of illuminating engineering as a means of advertising occupied 2 per cent. of the printed pages, which, if the opinion expressed in discussion may be accepted, was at least 2 per cent. more than it was entitled to.

This numerical analysis may be of little value, but if the reader differs with any of the conclusions he is entirely at liberty to draw whatever others he pleases.

The Need of a General Housecleaning in the Fixture Business

One of the most generally recognized principles of successful retail merchandizing is keeping the shelves and stockroom cleared of dead stuff. Hanging on to out-of-date goods because they cannot be moved at a profit over their original cost is a fallacy that has sent more than one establishment into the hands of the sheriff. There is an element of speculation even in the most conservative lines of buying and selling, the profit or loss being contingent upon a number of factors which at best can only be partially known. It is easy enough to make an article, or to buy it, if funds are available; to sell at a profit is a matter requiring a degree of experience and ability. But even with these qualities in ample measure chance

enters into the problem. The article may not take the fancy of the buying public; or there may be overproduction of the particular type of article; or by the time that it has been manufactured and passed through the usual channels of purchase down to the consumer, a different or a better article may have been brought forth which will have the preference. Success depends upon knowing when to take a loss as well as upon picking the goods that can be sold at a profit.

What's the Matter with the Fixture Business?

If their own statements are to be taken at par, the fixture manufacturers are, to say the least, in a condition that is far from satisfactory. And the most pessimistic reports come from the largest and oldest of the concerns. It is the "cheap skate" around on the side street, or the "piker" in the next town that is ruining the business by their cheap product. It reminds one of the classical exclamations of Bill Nye, that "we are ruined by Chinese cheap labor," in his adventure with Ah Sin in "the game which he did not understand." The "cheap skate," of course, is making "rotten stuff"; but also he is making money, which isn't rotten. And the "piker" in the next town is copying the designs and undercutting the prices, and incidentally adding to his bank account or his factory. Probably the quality of design and workmanship of the "cheap skate's" product is not equal in all respects to that of the time honored manufacturer; and it is to be feared that the percentage of the designs of the "piker" is not altogether legitimate.

But neither of these suspicions is sufficient to account for the difference between commercial prosperity and business stagnation. It will be found upon investigation that the maligned small manufacturer has a comparatively small variety of goods which is kept up-to-date, and that there is a minimum of capital tied up in defunct designs, patterns and tools. A perfectly unbiased examination might also disclose the fact that the goods were not so inferior, either in design or workmanship, as ought to be the case, coming as they do from a mere "butter-in," in fact, it might even be disclosed that the designs were particularly fresh and free from the ancient traditions of the trade, and, all things considered, sold at a very reasonable price, albeit leaving a fair margin of profit for the maker.

A booklover was showing a friend his library. "These," said he, pointing to a small case, "are the books that I have read."

"Ah," said his friend, "and what then are all these volumes?" pointing to the cases on the other three sides of the room.

"Those are the books no library should be without."

The fixture catalog of the old time manufacturer may be classified in a very similiar manner. On a dozen pages perhaps could be placed the designs that sell; the other 988 pages contain the fixtures that no reputable fixture house should be without. And the same might be said of many of the lighting glassware catalogues.

The Relation of Fixture Manufacture to the Scrap Metal Industry.

Much has been written on the relation of fixtures to architecture and to illuminating engineering. There is urgent need of a treatise on the relation of lighting fixtures to the scrap metal industry. A reciprocity treaty put into active and cordial co-operation between these two lines of trade would produce proportionately far more beneficial results than the late lamented reciprocity treaty with Canada. The opportunity for a general house cleaning in the fixture trade is beyond the dreams of the most avaricious junk dealer. Nine-tenths of the designs shown in the ponderous, fly-blown catalogs are mere padding for the catalog and a useless investment to the manufacturer. They do not increase sales, but rather tend to confuse the customer and turn him away in despair. After going through one of these family albums, who can blame the customer if he turns to the "pirate" and "cheap skate," who shows him a half dozen fresh, neat designs within his limits of price and suited to his needs. Suppose that you should go into a drug store and say, "I have a mosquito bite; what preparations are good for it?" and the clerk should hand you out the pharmacopeia and

say, "That gives every known substance used in medicine, from which you will therefore be able to select the proper remedy for your case," would you be inclined to start in and wade through its thousand or fifteen hundred pages, or would you dodge around the corner into the little shop where the proprietor would offer you your choice of a couple of remedies, either of which would be entirely satisfactory? If the majority of the older fixture houses would go into dry dock and scrape the barnacles off of their bottoms, they would find that they could make much better headway against the adverse winds of which they are now complaining.

Types of Illuminating Glassware and Their Names

The nomenclature of photometry was in a sadly muddled state in the early days of illuminating engineering. Thanks to the efforts of the Illuminating Engineering Society in this country and to the published articles of illuminating engineers embodying both destructive and constructive criticism, this subject has been fairly well straightened out; the incorrect or ambiguous use of photometric terms is now rightly taken as direct proof of ignorance.

The names used to denote the various species and varieties of illuminating glassware, on the other hand, have increased in obscurity and awkwardness; and this darkening of knowledge by words without meaning has increased its momentum during the past year.

Until two or three years ago there were practically but two kinds of glass made for use in connection with illumination; "crystal," glass as purely transparent as can be made; and "opal," glass rendered white and translucent by various methods of manufacture.

Crystal glass is rendered translucent by acid etching or sand-blasting on one or both sides. Acid etching is capable of giving several different effects according to the chemicals used, while sand-blasting may give a coarse or fine grain according to the size of the sand particles used in the blast. Crystal glass roughened by sand-blasting on the inside has come to be staple, being known in the trade as "CRI."

Opal glass has been made in every degree of translucency from the solid opal which barely shows itself luminous with light of ordinary intensity back of it, to such a degree of transparency that the form of the source is distinctly seen through it. The degree of translucency is varied by both physical and chemical means. In the former case, crystal glass is coated with a layer of opal glass of greater or less thickness according to the degree of translucency desired. In the latter case different chemical formulas are used.

In its chemical composition opal glass may be divided into two kinds; cryolite opal and boneash opal. Cryolite is a mineral containing hydrofluoric acid in combination and is used to produce dense opal. Boneash contains a considerable per cent. of calcium phosphate, which has the remarkable property of producing a glass that is clear or transparent when it comes from the melting pot, but which turns translucent on being reheated and cooled. Boneash opal has a rich orange color by transmitted light, the shade varying with the thickness of the glass, while cryolite opal has a bluish tint.

"Opalescent" and "alabaster" are vague words used to denote opal glass of different degrees of translucency, sometimes one and sometimes the other word denoting the greater density. Opal glass when blown or pressed has the highly polished surface of crystal glass. This is sometimes depolished or rendered matt by etching or sand-blasting. Dense opal glass thus depolished furnishes the best practical diffuse reflecting surface known. Like all matt surfaces, however, it is difficult to clean.

Several years ago a type of glass was brought out, which was new in America, and could be classed neither as crystal nor opal. It was a translucent glass consisting of a matrix of crystal having distributed through it visible particles of white substance, together with a certain proportion of invisible particles. This distinguishes it from opal glass, which contains only invisible white particles. The glass differs in general appearance both by

transmitted and reflected light, in the former case showing no change of color of the original light, and in the latter a more or less pearly, matt surface instead of the high polish of ordinary glass.

The first American manufacturer to bring this glass out gave it a trade name. As would be expected, the other makers of lighting glassware have brought out a glass of the same general type to which each has given a special trade name. There is a serious need of a generic term for this material. As opal glass was named by analogy from the well-known gem to which it bears a more or less close resemblance, the new glass might, by a similar analogy, be called "moonstone glass," as the more translucent forms of it very closely resemble this peculiar gem. As the case stands there are some half dozen different makes of substantially the same glass, all going by different names, while there is no single word to express the type.

The lack of definite or exact terms in expressing the purpose of glass accessories has also been generally felt. In ante illuminating engineering days the word "shade" was applied to anything used in connection with an artificial light to modify its rays. The word "globe" was almost equally universal in its application. The word "reflector" has come into use in a somewhat definite way; but most reflectors at the present time transmit more or less of the light, and thus, in the old phraseology, might be called "globes" or "shades," as well as reflectors. The word "reflector" is exact only when applied to a device that it is intended for a reflector only—that is, an opaque reflector. We have no satisfactory term for the transmitting reflector, nor is there any generic term indicating a translucent glass envelope or accessory.

Probably these omissions will be supplied by the natural process of growth, but perhaps this growth might be forced by a little effort on the part of writers and scientific bodies dealing with the subject.

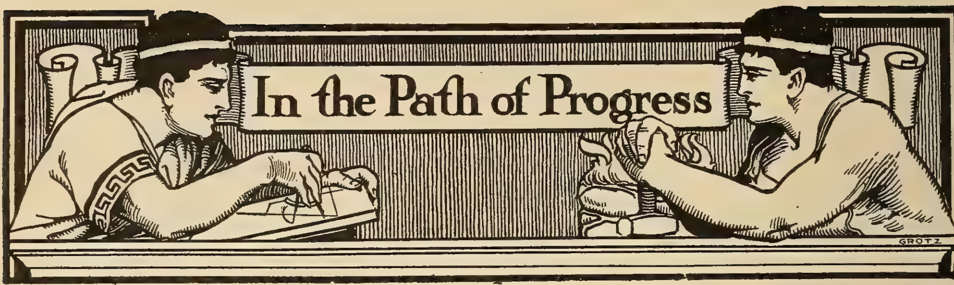
The National Commercial Gas Association

The coming convention of this association again brings it prominently before the lighting field. Following the method of the old-time preacher, we may take up our text word by word. We first encounter the word "National." Our national spirit is fostered not only by our free interstate and intersection trade, but by business and social organizations as well. Although we are one people we live under various conditions, and draw the inspiration for our actions from various motives and sources. The conservatism of the East needs the leaven of the push and adventure of the West, and our habits of social refrigeration born of the older and larger centers of trade need thawing out by the warmth of Southern temperament and the enthusiasm of the growing town.

The second word in our text is "Commercial," which defines the central purpose of the association. Again, we must cut the discussion short with the statement that commercialism is not essentially bad, as some moralists would have us believe, but is fundamentally good. To come together for the purpose of comparing and exchanging the results of our efforts is essentially elevating and broadening.

The concluding words indicate an association of men whose main business of life touches on more or less extended lines of contact. It implies co-operation, which is the watchword of progress at the present time. Co-operation is not only here, but has been with us for some time, and will continue to thrive in the immediate as well as the remote future.

The National Commercial Gas Association has already given a satisfactory demonstration of its right to existence. Its field for operation is a large one, and with the continually increasing interests shown by its members in the work for which it has been planned still greater success is bound to crown its efforts in the future.



A New Indoor Gas Arc Lamp

As the proper sphere of the gas arc lamp is being more generally appreciated, the need for a greater range of available sizes has become manifest.

The 5-mantle gas arc has been principally used for outside lighting of a more or less spectacular nature, such as the exterior illumination of business places, Great White Way installations, etc. On account of its high intensity and the nature of its distribution curve, the gas arc has been quite properly regarded as unsuited for places where the best effects in illumination are desired. The increasing tendency toward the use of smaller units, well distributed, undoubtedly makes for better and more economical illumination,

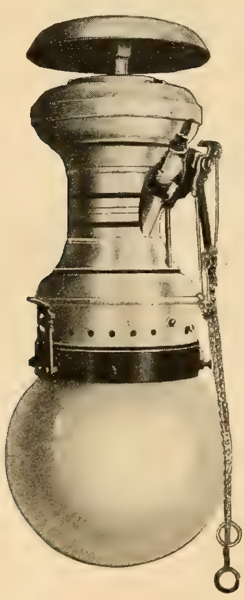


FIG. 1.—NEW THREE-MANTLE INTENSO LAMP.

but the initial and maintenance costs are in nearly all cases somewhat higher than with fewer and larger units. There is therefore a considerable field in which gas arc lamps may be used to excellent advantage.

Wherever low first cost and maintenance expense are of more importance than good illumination, low operating cost and artistic appearance, the gas arc lamp finds its proper field of usefulness. Also whereever the use of the lowest possible number of units is almost imperative, as in certain types of industrial plants, where the density of production is high and the attention to the lamps interferes with crane service, or otherwise unduely hampers production. For such purposes both upright and inverted 4-mantle interior gas arc lamps were developed.

The lack of smaller units than the 4-mantle lamp has imposed a certain inflexibility in design which has militated against the most effective use of the gas arc lamp in many cases, and the Welsbach Company, Gloucester, N. J., has endeavored to remove to a degree this limitation by furnishing the Intenso type of interior gas arc lamp in a 3-mantle size. This lamp utilizes the single needle valve and mixing chamber construction first introduced in the 4-mantle Intenso, which has practically revolutionized gas arc lamp construction, having been quite generally adopted in the later designs of lamps of this character. Aside from the fact that this construction enables the fitter to adjust all mantles by a single needle valve, and only one gauze requires attention, it possesses a further advantage of operating satisfactorily over a wide range of pressures and gas qualities. In one extreme case, satisfactory service was obtained on mains in

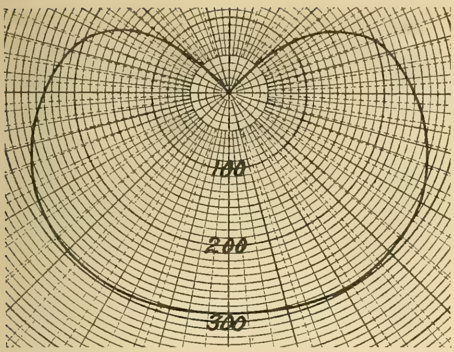


FIG. 2.—PHOTOMETRIC CURVE OF NEW THREE-MANTLE INTENSO LAMP.

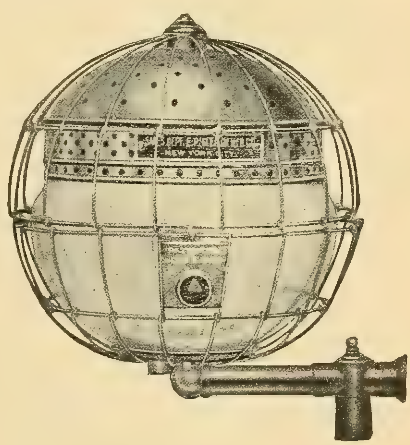
which the pressure fluctuated from 4 to 10 in. While this is entirely outside the range of good gas practice, it illustrates the flexibility of this type of lamp.

In designing this lamp, special pains were taken to make the exterior appearance as attractive as possible, a detail in which arc lamps in general are deficient. As shown in Fig. 1, the lines of the lamp casing are more pleasing than those commonly found in units of this character. The casing is finished in white enamel with gold striping, possessing the double advantage of being unobtrusive and easily cleaned. The accompanying curve, Fig. 2, shows the distribution characteristics of the 3-mantle Intenso.

The candle-power figures represent results obtained on water gas at 2½ in. pressure on lamps equipped with standard stock mantles. At 3½ in. pressure, which is quite generally coming into use, an increase of about 15 per cent. in candle-power would be obtained. With special testing mantles, a further increase in candle-power of about 25 per cent. would be obtained, but as such mantles are too short lived for commercial purposes, the Welsbach Company reserve the results of such tests for laboratory comparisons only, publishing no test except those representing the average performance of lamps equipped with stock mantles, believing that while this very conservative practice may temporarily depreciate the efficiency of its products in the eyes of superficial observers, ultimately its best interests are to be served by the rating of lamps upon such a basis that the published performances of lamps may be reproduced in any laboratory.

A Protective Device for Gas Lamps

The necessity of protecting a light-source against meddling or mischief has been recognized in the electrical field for some time by the production of practical devices for locking lamps in sockets, and guards over lamps. A device of this nature has recently been brought out which is applicable to gas lamps, either flame or small mantle burner. It consists of a glass globe with a metal top surrounded by a strong wire cage, the latter being fastened with a lock. The device is shown in the illustration. It is already in use in a number of public buildings in New York City. If it were used in all cases where such protection is essential it would have a large sale. As an example of such use, the lighting of stairs and hallways in tenement houses and factories is a case in point. In the present usage these lights are small gas flames left entirely unguarded; and why there are not more fires resulting from this gross negligence of ordinary protection is a mystery. While the special commission appointed by the State to investigate the methods of fire protection are at their work they would do well to look into this simple and practical device. This device is manufactured by the E. P. Gleason Mfg. Company, New York.



THE GLEASON SAFETY GAS GLOBE.

The Association of Iron and Steel Electrical Engineers

The association held its convention in New York September 29, at which a paper on "Iron and Steel Works Illumination" was presented by Mr. C. J. Mundo. The author analyzes the problems very carefully, and gives a summary of the illuminating engineering principles involved. Of particular value is a complete table of "minimum satisfactory illumination intensities" for all the different conditions met with in steel mill operation. The paper is a careful study of the whole subject, and would be fairly exhaustive but for the omission of any information on the Cooper Hewitt lamp. This is a somewhat serious omission as this type of lamp has come into very considerable use for this class of work. A more extended review of this paper will be given in our next issue.

International Municipal Congress and Exposition

At this exposition, which was held in Chicago September 18 to 30, one of the afternoon sessions was given to the discussion of Public Utilities. A paper on "Public Lighting" was presented by Mr. E. Leavenworth Elliott. The writer gave a general review of the subject, treating it chiefly from the viewpoint of the citizen and public official. A further review of the paper will be given in the next issue.

New England Section of the N. E. L. A.

The fall convention was held at Bretton Woods, N. H., opening September 27. Mr. B. F. Fisher, Jr., presented a paper on the "Wire Type Tungsten Lamp." The writer states that in all processes of manufacture the lamp filaments consist of pure tungsten, and that although the metal can be produced in a ductile form it rapidly loses this quality after being heated in the lamp, so that filaments made by the pressing or sintering process are as durable in life as those made by the drawing process—or slightly better, if anything. The method of supporting the filament in the lamp has more to do with the ability to stand mechanical shock than the method of preparing the wire. The disposal of the filament so that it consists of one continuous wire supported loosely in the loops of the supporting wires produces the greatest ruggedness.

Personal

Mr. J. S. Codman, one of the veterans in illuminating engineering, having been interested in the movement since several years before the "official" recognition of the science, has at last given up active work in the lighting field, and has cast his lot in the electric vehicle field, having secured an interest with S. R. Bailey & Co., of Amesbury, Mass.

Mr. Codman's retirement from active service in the lighting field will be noted with regret by a large number of friends, and by those who have profited by his careful and conscientious work. If good wishes for success in his new line will avail, he will certainly achieve all that heart could desire.

The Jefferson Glass Company, of Follansbee, W. Va., manufacturers of general lighting glassware, including their special "Luceo" reflectors, announce the appointment of Mr. M. E. Trimble as Eastern sales manager, with offices and showrooms in the Tilden Building, 105 West Fortieth Street, New York City. Mr. Trimble has had large and varied experience in the lighting field, and should find an attactive outlet for his abilities in promoting the excellent line of accessories which he represents.

R. Hanschke, Jr., E. E., M. E., graduate of A. and M. College of Texas and University of Hanover, Germany, has recently accepted position of Eastern Representative of the Charles L. Kiewert Co. (headquarters, Milwaukee, Wis.), the well known importers of all kinds of flaming, searchlight, and renowned "Bio" carbons, and Alba and Aurola flaming arc lamps. His office address is 165 Greenwich Street, New York City, in the heart of the electrical district of the metropolis.

Mr. A. H. Krom, formerly employed by the Commonwealth Edison Co., as commercial and illuminating engineer, will have charge of the illuminating engineering and sales of the Chicago branch at the Marine Building, 136 West Lake Street.

Proceedings of Technical Societies

The Illuminating Engineering Society

FIFTH ANNUAL CONVENTION, HELD IN CHICAGO, SEPTEMBER 25 TO 28.

The first session was opened Monday morning, September 25, at eleven o'clock. A brief and informal address of welcome was given by Mr. John F. Gilchrist, which was followed by an equally brief response by Mr. Joseph D. Israel.

In the absence of the president, Dr. A. E. Kennelly, his address was read by Mr. Van Rennsalaer Lansingh. Professor Kennelly took for the subject of his address "The Relations of the Physico-Physiological Research to Illuminating Engineering." After stating very briefly the natural stages of development of any branch of science, and pointing out that all science is based on measurement, the president mapped out the lines along which further investigation is needed in order to put photometry upon an absolute physical basis of measurement.

It is well understood that ordinary light is, subjectively, the sensation produced by radiant power, which, in its turn, is the power of alternating electric waves in space within a certain range of frequencies, representing about one octave, and lying between the approximate limits of 400 and 800 millions of millions per second. When such alternating-current power, or rate of transfer of energy, exists at a given position in space, an observer placing his eye so as to intercept it will receive the impression of light, provided that the power-density, in watts per normal square-centimeter, is not less than a certain small threshold value, at which the stimulus begins to be perceived, on the one hand; nor more than a certain much larger value, at which, on the other hand, the stimulus is excessive and dangerously great. The values of these power-density limits are, as yet, only very imperfectly known, for even a single frequency.

It is also known that the sensation of light, or the candle-lumens per unit of radiant power-density is very different for different frequencies of electric alternation. If, to avoid periphrasis, we call the unit of radiant power-density (one watt uniformly and perpendicularly passing through one square centimeter) one area-watt, then one area-watt received by the eye will give rise to the sensation of more light in the yellow-green frequency than at either end of the spectrum. The lumens per area-watt are known to be greatest at or near the frequency which is most prominent in daylight. But when the radiant power-density is feeble, and the candle-power perceived is low, the lumens per area-watt are known to be greatest at a somewhat different frequency; so that the relative sensibility of the eye to stimulus, at different frequencies, varies with the intensity of the stimulus. In all of these particulars, a good start has been made toward quantitative knowledge, and the literature of the subject is already large; but far more remains to be investigated before our knowledge can be regarded as satisfactory along any of these lines. We ought to know the lumens per area-watt produced in the normal eye for each color, and its frequency, as well as for all working intensities. Beyond this, there remains to be found how far the normal is departed from in the eyes of different ages and races of men, as well as the effects of attention, of training, and of physiological fatigue.

Assuming that we possessed a proper knowledge of the lumens per area-watt, for all the different colors and frequencies of light, at all working intensities, it would become possible to make a spectro-photometrical examination of the light from any lamp, say a Welsbach mantle burner, then average the lumens per area-watt over the whole of its spectrum, to measure the total radiant power of the burner in watts, and then express the radiation-density watts per lumen in a significant manner.

Moreover, assuming that we had a satisfactory knowledge of the sensation-effect of radiant power-density, it would be valuable to know the sensation-effect of radiant energy-density. That is, if a certain quantity of electro-magnetic energy, uniformly and perpendicularly flowing through each square

centimeter of area, were intercepted by the pupil of an observer's eye, what would be the sensation effect?

It might at first thought be supposed that the knowledge, in a few laboratories, of certain physical-physiological constants for the human eye was of no importance to the broad industry of illumination, to its manufacture, engineering, distribution or sale. Nevertheless, it may well be contended that, on the contrary, all such knowledge is of great importance to the industry in many ways. In the first place, disputes tend to vanish when the matters in dispute are properly known to a specially trained few, even though the facts may be out of the line of vision of the many. Secondly, all such knowledge rapidly begets applications, improvements, economies, in a manner of which modern experience affords many examples. If only for the utilitarian advantage of such research, this address is offered as a plea for the accumulation of observations on the photometric properties of our eyes, by all who may have the opportunity to make them.

It will doubtless surprise many to be informed that the absolute measurement of light is identical with the measurement of electricity. To some it will probably seem stretching a point to refer to light as a form of electricity, for no other reason than that the cause of visual sensation is to be found in ether waves, and electricity is also manifested in ether waves, though of a very different physical character. However, the majority of the illuminating engineers will be quite content to leave this whole subject to the care of the student of pure science, and will be ready to apply results as soon as they are put into a form that he can handle.

Report of the Sub-Committee on Photometric Units of the Committee on Nomenclature and Standards.

A very brief report was presented, stating that the sub-committee had been in communication with various authorities in different countries.

Prof. André Blondel, who was responsible for the present system of photometric nomenclature, is particularly active in the work of securing international co-operation. The report contains the following recommendations:

The committee would make the following recommendations:

That the term "lighting" be used to designate the product of luminous flux by the time, the symbol therefor being "L." The "L" then would displace the "O" used as a symbol for this quantity in the 1910 report. The committee would further recommend the adoption of the following symbols:

Mean spherical candle-power, $I\ominus$.

Mean upper hemispherical candle-power, $I^{\frown}$,

Mean lower hemispherical candle-power, $I_{\smile}$.

Total flux, $F\ominus$.

Upper hemispherical flux, $F^{\frown}$.

Lower hemispherical flux, $F_{\smile}$.

These symbols have been proposed by M. Blondel and differ but slightly from those used in Germany, the bar being carried a little beyonl the circle on each side. The idea is that the symbols will be less liable to confusion if this form is adopted.

The committee would further recommend that negotiations with individuals and societies in other lands be carried on with a view to the possibility that eventually this society will arrange for an international conference to bring about an agreement on these subjects.

Report of the Committee on Progress.

The subject of this report is considered under three headings: "Materials of Illumination," "Methods of Illumination," and "General Progress in Illuminating Engineering." Under the first are traced such improvements in electric and gas lamps as have been introduced during the past year. Among electric lamps the long burning flaming arc is dealt with at some length, the conclusion being as follows:

Without examining these things in detail, it is within conservative bounds to say that there are now several lamps on the market capable of giving a burning life of about 75 hours per trim, at an efficiency which, while not quite as good as would be reached by intensive burning of the same electrode, is still from a practical standpoint very satisfactory. It seems somewhat dubious whether the burning life can be increased beyond the point mentioned to any material extent without objectionable loss of efficiency, and the amount of debris produced by the combustion of the long burning electrode is sufficiently great to cause a material reduction of light during the progress of the single trim, unless the globes are cleaned at intermediate periods. The strongest point of these new lamps is that they may be successfully applied to alternating current and give a useful and efficient lamp of very much

higher efficiency than any of the alternating arcs heretofore employed.

The so-called " intensive " carbon arc is stated as having an increasing use, and as giving the " closest approximation to white obtainable in any efficient commercial illuminant." The quartz mercury arc has come into commercial use within the year. This use, however, must be extremely limited. The report states that " it gives promise of usefulness in the lighting of streets and large spaces when it shall be readily obtainable in this country." The use of neon in place of air or carbon dioxide in the Moore tube is mentioned as " a notable step in the evolution of gaseous luminants."

The production of the drawn wire tungsten lamps, and the use of lamps of large sizes, 400 to 500 watts, has marked the chief advances in the incandescent electric lamp.

In the production of light from gas the improved mantles, particularly those made from artificial silk, which give a much longer life and uniform maintenance of candle-power, represent an advance step. High pressure gas lighting has made no substantial progress in this country. The inverted mantle lamp is rapidly replacing the old upright type, and is destined to become the standard gas lamp.

In methods of illumination, the report says:

> During the last year there have been many outdoor installations of a so-called decorative character, and some of them, it is to be regretted, have violated most of the canons of the art. The lavish and reckless use of unscreened arc lamps in display lighting has been on the increase, and it is perhaps not going too far to say that with the best of intentions the average flamboyant lighting scheme of the last year or two is from the standpoint of the illuminating engineer bad. There is a slight tendency toward the use of diffusing globes for arcs, which deserves to be encouraged; but for the most part extreme brilliancy seems to be the one thing to be desired in such installations. Some few ornamental installations of tungsten street lamps in diffusing globes are notably good, although not always satisfactory from an economic standpoint. On the streets even display illumination should be designed with due regard for economy, so that a system, once the effect of its newness has worn away, may not be regarded as a financial burden and eventually abandoned.
>
> In indoor lighting the most notable tendency has been towarl the use of indirect, and more especially semi-indirect, illumination. Some of the fixtures which have been worked out for the latter scheme are very beautiful in design and yet not economical, as is commonly the case with the pure indirect system with opaque coves or reflectors. Progress in this line deserves to be encouraged, especially from the decorative standpoint, in which it is often superior to either ordinary direct or indirect systems.

The improvement in reflectors for industrial work and in sockets and shade holders is noted. The light transforming reflector of Dr. Peter Cooper Hewitt, by which the shorter wave lengths are transformed into red light, thereby supplying the missing color in the mercury vapor lamp and rendering its light approximately white, has appeared during the year.

On the general progress of illuminating engineering the report is disappointingly brief. Besides a general increase in public interest in the subject and recognition of the work of illuminating engineers, the organization of the American Association for the Conservation of Vision, and the commisson appointed by the French Minister of the Interior to investigate the subject of illumination, constitute the most important evidences of progress noted.

The members of the society are particularly anxious to know to what extent the actual use of illuminating engineering is increasing, as shown in the specific application of its principles in the laying out of lighting installations. There seems to be very little reliable data on this important point, and it would be well worth a considerable effort on the part of the Committee on Progress to ascertain the facts in this respect.

THE MANUFACTURE OF GLASS FOR ILLUMINATING PURPOSES, by E. H. Bostock.

The author attempts to run through the entire subject of glass making, so far as it has any relation to illuminating engineering. The extent of the subject renders a superficial treatment absolutely necessary. The composition of different types of glass is given in a general way, and also the methods of manufacture. There are some errors in the statements which suggest a degree of unfamiliarity with the

subject on the part of the writer. While they are of no great consequence, still in a paper prepared for a scientific society technical errors are to be deprecated. Thus the writer says:

Most of the lighting glass used is produced by one of the three blown methods just described. There are, however, two other processes by which minor quantities are made. The first one of these is the press method in which the article is pressed into the shape of any given mold or die by a descending plunger. This process dulls the surface considerably and is not used extensively, except for special basins where cut steel dies are employed for high relief designs; or in the forming of ware afterwards to be acid or dull finished.

Modern lighting glassware is probably produced by the method of pressing to at least as great an extent as by blowing. Generally speaking, globes and shades intended for transmitting light are blown, while those designed to reflect light are pressed. There seems to be little doubt that the use of reflectors in the installations put in within the past few years at least has exceeded the use of diffusing globes. In the pressing process steel dies are never used, chilled cast iron being the material of which the moulds are made. While this process leaves the glass with a somewhat dulled surface, by means of methods of fire polishing and reshaping, which have been brought to marvelous perfection in this country, pressed ware is produced which rivals the forms made by the method of hand cutting. In all forms of white glass when used for reflectors the dull outer surface is advantageous.

Again, we find this statement:

If one has kept in mind the definition urged previously in this paper, it might be stated here that molten glass can be made any color; this is almost literally true. All colors are gotten by the addition of metallic oxides to the mass, and very great difficulties are sometimes encountered in their action at high temperature; but in the end, these are overcome and the expert glassmaker will furnish any desired tint of color.

The production of colored glass, especially of a transparent nature, is still very far from reaching "any desired tint of color." While it is easy to produce the primary colors,—red, blue and green, in strong, dense tints, it is a very different matter when it comes to producing shades, or hues; for the production of these it is still necessary to resort generally to surface painting or staining. The use of colored varnishes for producing colored incandescent lamps is a striking proof of the limitations in the manufacture of colored transparent glass.

Under the heading of "Reflecting Glassware," the writer states that "the highest efficiency is, of course, obtained with silver fluted glass." It would be interesting to know how the fluting increases the efficiency.

On the subject of "Translucent Glass" the paper leaves the reader in serious doubt as to what kind of glass is referred to. This is doubtless due to a squeamish anxiety to avoid the appearance of commercialism, but which impresses the reader as akin to the draping of a statue for reasons of modesty, which produce the very effect which it has sought to prevent.

The follownig paragraph needs this drapery removed:

The highest efficiency, of course, is obtained with silvered fluted glass.

For diffusive lighting the newest and the best development is that of the already well known phosphate glasses. The phosphate glass is the only glass which is not a clear colored solution; for it holds in a state of suspension innumerable particles of an opaque white color. Each one of the particles catches and breaks up the light, causing its diffusion over a wide area. By the use of phosphate glass a light source may be concealed so as to emit a soft and restful light. Moreover, this glass enables diffusive illumination to be obtained without the use of either sand-blasted or prismatic globes, thereby avoiding the collection of dirt which reduces the light flux. It can also be worked into any shape by blowing and pressing. The author believes, too, that no difficulties would be encountered in coloring it, although he has never seen it done. The inherent virtues of this glass will probably introduce a lot of imitations. The ordinary opal glasses of commerce are finished to resemble the phosphate glass, but they are lacking in several respects, principally in the element of diffusion. A close examination by a sharp eye will disclose the suspended particles in the real glass.

It apparently refers to the new glass of the moonstone type, which was first brought out under the trade name of Alba, but has since been produced by all the leading makers of glassware. The advantages of this form of glass have been frequently alluded to in these pages, and

there is no legitimate reason why it should not be discussed without any mystery surrounding it. To speak of the probability of its being imitated is a piece of ill-concealed advertising; one might as well talk about Bessemer steel being "imitated."

It may be well worth while to recall the fact, which we have already stated, that glass of this type has been made for fifty years or more in Europe, but has only recently been reproduced (not imitated) in this country. With these corrections the paper contains as much general information on so broad a subject as could well be condensed into the space occupied.

A Symposium of Illuminating Glassware, by George H. McCormack, Albert J. Marshall, and L. W. Young; with an Introduction by Bassett Jones, Jr.

The purpose of this symposium is thus set forth in the introduction:

> It has seemed to the Committee on Papers that there are several subjects which bear a very close relation to the profession of illuminating engineering which have been treated before the society in a more or less spasmodic or one-sided way. It has seemed wise that an attempt should be made from time to time to gather together into one place the best thought and knowledge available in these subjects and so present what, for lack of a better term, is called a symposium on these subjects.

Mr. Jones further states that it was the intention of the Papers Committee to include opaque reflectors as well as glass in the symposium, but it was found impossible to secure contributions on this subject. As for the treatment of illuminating glassware, the paper must be considered only a general synopsis. If the engineer who wishes full data on the subject will send for the literature, which may be had for the asking, issued by the Opalux Company, the Holophane Company, and the Macbeth-Evans Glass Company, all of whom can be reached in New York City, he will get not only what this symposium contains but much additional useful matter. The contributors to the symposium, who are connected with the sales departments of the three glass companies respectively, have treated the subject as well as could be expected under the limitations imposed upon their efforts; and had they not availed themselves of the opportunity to set forth their respective wares in the best possible light, they would have proven themselves too scientific and altruistic for the commercial positions which they hold. This is neither a criticism on the writers nor upon the several companies; on the contrary, it is a frank and outright recognition of the extent to which they have utilized illuminating engineering in the design and manufacture of their products, thereby adding most valuable practical contributions to the science.

Modern Requirements of Reflector Design, by F. Laurent Godinez.

This paper is practically a part of the "Symposium on Lighting Glassware." After explaining the physical structure of translucent glass as determined by the microscope, the writer comes to the real thesis of his paper, which is to show that opalescent glass reflectors are superior to prismatic reflectors, which question he argues with the use of much Johnsonesque language. Although by the title of his paper he is restricted to the discussion of reflectors, he enters at some length into the value of diffusing globes, referring particularly to those having an amber or old rose tint. On the question of color he says:

> Since the advent of the tungsten lamp the predominance of what has been termed "white light" effect has been quite marked amongst installations of the commercial type. This quality of light has been condemned by persons qualified to pass opinions on matters concerning art, on the grounds that its effect is harsh, giving a suggestion of tenseness to the features and an entire absence of harmony, expression, and ensemble.

The truth of this statement has been demonstrated in some recent installations in high-class hotel dining rooms and cafés, where brilliant illumination by tungsten lamps led to actual complaint on the part of the lady patrons, which resulted in the use of a certain amount of pink and amber shades to give the necessary warmth of tone to the light.

The writer then describes some new diffusing globes having an old rose or am-

ber tint. The balance of his paper is devoted chiefly to demonstrating the greatest degree of diffusion and less degree of glare of opalescent glass over prismatic reflectors, a point on which there would seem to be little room for argument. The most valuable part of the paper is the suggestion contained in the conclusion, which is worthy of very careful consideration by the society and all those interested in the promotion of illuminating engineering as a science and profession:

> The American Institute of Electrical Engineers and the American Society of Mechanical Engineers have published standardization tests of a most comprehensive nature. If the layman has reason to doubt the sincerity of the manufacturers' statement he can, and does, demand a test of the product in accordance with the standardized forms issued by these organizations.
>
> The opportunities afforded by illuminating engineering to charlatanism, with the extreme youth of those posing as illuminating experts, has created a decided mercantile prejudice against anything even resembling the mercantile conception of an illuminating engineer. While no manufacturer of standing will allow misrepresentations to be made by members of his sales force, a precedent has been established of that sort by salesmen lacking broad training and a proper knowledge of their competitors' product. If the merchant could feel that there was in existence an impartial standardization test with which he might demand compliance by any manufacturer, an instantaneous respect for illuminating engineering and an appreciation for the society affording him such protection would ensue.

NATURAL GAS: ITS PRODUCTION AND UTILIZATION, by George S. Barrows.

Mr. Barrows' paper was in the nature of a stereopticon talk, in which the various engineering problems connected with the production and distribution of natural gas were illustrated and described in a clear and practical manner. While the subject does not directly concern illuminating engineers, the address was both entertaining and instructive as collateral information.

RECENT SMALL GAS LIGHTING UNITS, by F. H. Gilpin.

The writer states that "in the general development of the present systems of interior lighting by gas, especially in residences, necessity has arisen for more variety in small sized units," and refers to the great range of sizes in incandescent electric lamps, in contrast with which gas lighting has been restricted to a single inverted unit of about 50 mean-spherical candle-power and an upright unit of about 85 mean-sperical candle-power; the larger lamps, or so called arcs, being multiples of these units.

The body of the paper is then given to the report of very careful experiments on a number of small units of English, German and American design. The results show that the efficiency of the small units is from 25 to 30 per cent. above that generally obtained from similar units of larger size.

This should be cheering news to the gas lighting interests. There is unquestionably a very large field for the smaller units, and it only requires a reasonable amount of pushing to supply this need. The great majority of gas and combination fixtures put up are supplied with three or more outlets for gas, equipped with flame tips. As a single unit of the present large size is usually ample to light a room the result is that only one of the arms of the fixture is equipped with a mantle lamp, which throws the whole fixture entirely out of balance and converts it into a thing of ugliness no matter how well it may be designed. The use of a small unit on each outlet will do more than anything else toward placing gas light on a par with electricity in point of decorative effect.

The following paragraph contains a useful summary regarding the qualities of mantles and burners:

> At least three elements determine the success of a gas unit. First, the point having possibly the greatest importance is the mantle. On its mechanical structure and chemical saturation depends its ability to withstand shocks and hard use. Here is where the installation not under maintenance shows most conspicuously its deterioration. Secondly, should be considered the structure of the burner itself. On the smoothness of the interior finish depends the amount of trouble caused by stoppage due to the accumulation of dirt and dust, fouling of orifices and gauzes and the corrosion of important parts. These troubles may at times be beyond immediate remedy and result in the condemning and discarding of the lamp. Third, while less trouble is incident to the breakage and soiling of glassware, yet care should be taken in the design, so as to permit

of easy removal for replacement by cleaning. The first two points mentioned are of great importance, inasmuch as they are beyond the control of the average user of gas and directly affect the performance of the lamp.

Recent Developments in the Manufacture of Incandescent Electric Lamps, by J. E. Randall.

In this paper the writer gives a condensed history of the development of the incandescent electric lamp for the past ten years. In regard to the carbon lamp, he states that "the best lamps of ten years ago were as good as the best of the present year." The average of quality, however, has risen somewhat, owing to closer elimination of defectives. The metallized carbon filament lamp has improved 33 per cent. since its introduction in 1907, and the writer states what is evidently true, that "the Gem lamp shows a sufficient superiority in quality over the regular carbon filament lamp to justify its more extensive use." The question will at once suggest itself to the customer, "Why should not this improved form of filament be made to the entire exclusion of the inferior product?"

The metal filament lamp had its origin in the Osmium lamp, developed by Dr. Auer von Welsbach; and the writer states that "the most successful commercial methods [of making pressed tungsten filaments] are really variations of the original Auer process." Regarding the tantalum lamp, he says that it "cannot continue to compete with the drawn wire tungsten filament lamp in its present form." Of the drawn wire tungsten filament lamp, the following contains the principal facts:

The best lamps of ten years ago were as good as the best of the present year. The average has arisen due to the elimination of defectives.

It was evident, therefore, that to make the tungsten filament lamp a universal lamp, it would be necessary to have the filament in the form of wire which was sufficiently ductile to be wound, when cold, upon a spider structure. The drawn tungsten wire has met this need. While the wire before being placed in the lamp is amply ductile for the purpose of winding upon the spider and for all other manipulations needed in making the lamp, it loses much of this ductility when current is passed through it in a vacuum. The method of supporting the wire on the spider and of attaching it to the circuit terminals are, therefore, important factors in the hardiness of the lamp.

It was brought out in the discussion, that the question of the ductility of a lamp filament when cold is purely a manufacturers' problem which does not concern the consumer, who is interested only in the performance of a lamp after it reaches his hand. "The method of supporting the wire on the spider, and of attaching it to the circuit terminals," are therefore not only "important factors in the hardiness of the lamp," but are the final conditions to which the nature of the cold filament is subsidiary.

The summary of the paper giving a general comparison of incadescent lamps is as follows:

The wire may be considered to consist of pure tungsten. Chemical analysis does not find other elements. The ratio of resistance hot to resistance cold is as high as can be found in any other form of the metal. The specific gravity is higher than that found for the pressed filament. The current and the candle-power peaks are low.

The structure of the metal appears to be fibrous. It changes to the crystalline form during the burning life of the lamp. This change may occur in some portions of a filament and not in others. Frequently, after the full burning life, small sections of filaments will be found that show ductility.

Tests indicate that the wire is less brittle at every stage in the life of a lamp than are pressed filaments. There is no offsetting, either on direct or alternating-current. The surface is the same in appearance, after the lamp has been burned as that of a pressed filament. It looks as if the wire had been cracked into irregular pieces and as if a cement of the same material had filled up the cracks. No fissures at the surface and no cavities in the body have been found.

While the wire, before being placel into the lamp, may be ranked with the toughest steel in tensile strength, ductility and elasticity, the decay of these properties after it is in the lamp makes it necessary to handle these lamps with reasonable care in order to prevent breakage. Breakage in transportation and handling compares with that for carbon filament lamps. Operatives in the lamp factories transfer lamps having wire filaments from operation to operation the same as if they had carbon filaments.

Having traced recent developments up to the latest, it may not be amiss to consider the future. If the progress in lamp development may be gaged by the highest filament temperature at which each new lamp will show a given performance, one has a rational measure. For example, if 90 per cent. of the theoretical candle-power hours are developed in 1,000 hours burning, candle maintenance and mortality both considered, the advance from the raw carbon filament

lamp to the tungsten filament lamp will show something as follows:

Raw carbon filament lamp (cellulose carbon)	100
Treated carbon filament lamp	119
Metallized carbon filament lamp	149
Tantalum filament lamp	206
Osmium filament lamp	270
Tungsten filament lamp	359

This comparison excludes many items, such as process difficulties, lack of wattage range, lack of voltage range, lack of suitability for both alternating- and direct-current, cost, etc., which affect commercial values. It is not a comparison of commercial values, although it is a comparison of the most-important element in commercial values, namely, the energy wasted in doing equal work.

The change introduced by the metal filament lamp is noteworthy. Can carbon, with its many good qualities, reach or pass the record set by metals? The carbon deposited upon the treated carbon filament, when metallized, is dense, somewhat flexible, has a low vapor tension, has a fine quality of surface and has a cold specific resistance that is about 4 per cent. of carbon made from cellulose. All these qualities are favorable. Their further development may again place carbon in the race.

The last sentence in this summary is particularly significant, coming as it does from one who must be intimately acquainted with the research work that is being done for the purpose of still further improving the incandescent electric lamp.

The Analysis of Performance and Cost Data in Illuminating Engineering, by Ward Harrison, and H. H. Magdsick.

In this short paper the authors set forth the need of certain data, and the lines along which it should be gathered and arranged, rather than attempting to give facts and figures. The plea which they make for systematized information is so well put and so important to the real progress of the science as to make it worthy of extended quotation:

This paper is presented with the hope that it may aid the man interested directly in the application of light sources in making a thorough and logical analysis of the performance of available units, and further that it may lead to the publication of a large amount of reliable data, which is necessary for such analysis.

The papers that have been presented before the society during the past few years may, in general, be divided into three classes. The first includes those dealing with the basic principles of illumination, photometry and the allied branches of science and the theoretical considerations involved. The second group takes up the manufacture of various illuminants and a description of their mechanical details and operation. The third group deals mainly with a description of installations and with reports on illumination tests. Between the second and third groups there remains a field which although it is perhaps of the greatest interest to the man engaged in the practise of illuminating engineering, has scarcely been touched upon in the papers presented; that is, a study of commercial light sources as such.

The conditions which must be met in order to obtain satisfactory lighting are relatively well understood, but there are few men who have more than a very general knowledge of the actual service performance and operating cost of the units at their disposal. Much data is available from which the illuminating engineer may determine with a considerable degree of accuracy what initial intensity he will obtain from a given installation, but to calculate the initial illumination to a high degree of accuracy when the average performance in service is oftentimes not known within twenty-five to fifty per cent., seems an unnecessary refinement; and only too frequently no allowance is made for such depreciation when an installation is planned.

The small manufacturer or business man is not warranted in assuming the expense of extensive tests which would satisfy him as to the relative merits of two illuminants, but at this time there seems to be no other way in which he may obtain information of the reliability of which he has any assurance. The mass of conflicting data furnished by the manufacturers of the various lighting units naturally arouses in him a certain suspicion of all such information. Several large corporations have undertaken elaborate investigations of the comparative merits of different light sources for their particular class of work. Anyone who has attempted to go into this subject thoroughly realizes what a mass of evidence must be secured and how much money must be expended to obtain even a small amount of conclusive data. It is not surprising, then, that some of these tests have not led to satisfactory results. In any case, if each manufacturer or each corporation is compelled to undertake its own investigation, there results a useless duplication of material, which is extremely wasteful.

If this data could in some manner be brought together, tabulated in systematic form and subjected to the criticism of engineers capable to pass upon its worth, it would be of inestimable value to illuminating engineers. This is a matter of vital interest to a majority of the members of the society and it seems highly desirable that papers upon this branch of the subject should more frequently find a place in the Transactions.

The authors realize that it is no small task to bring together the data now available and that it is difficult to set up equitable standards of comparison; however, through co-operation among the members the material could in due time be put into useful form. If the manufacturers of the various commercial illuminants were invited to prepare papers on their respective products, contributing complete performance and cost data, this material would doubtless be augmented by the experience of illuminating engineers and consumers, and a fund of information would be provided upon which a man engaged in the practise of illuminating engineering might draw with a feeling of security; data which would bear the stamp of impartiality and reliability as engineering information rather than advertising material.

Few seem to realize the importance of including in an analysis all factors which determine the relative value of illuminants; at any rate, one seldom finds a comparison which is thorough and complete; and this is true in spite of the fact that the considerations involved are of an elementary nature. Doubtless some of them are difficult of exact statement; nevertheless they require careful attention. Certain of these considerations the authors regard as essential in forming a satisfactory judgment of the value of lighting units, and while they may not be entirely comprehensive, they have been found of great assistance in work of this character. The more important items may be grouped under two heads; first, illuminating power, and second, cost.

This is the most definite piece of constructive criticism on the work of the society that has yet appeared in its Transactions. While there has been considerable talk on the necessity of " broadening the scope " of the society by considering the subject as an art as well as a science, it has never been reduced to the specific suggestions contained in this paper. The implied criticism that the data thus far supplied along these lines does not " bear the stamp of impartiality and reliability of engineering information rather than advertising material," is unfortunately only too well founded in fact; and the suggestion that such data be " subjected to the criticism of engineers capable to pass upon its worth," is one that should not be left unheeded.

Impartial and reliable information, however, will never be brought together until it is secured or checked up by a body of engineers having no commercial relations with the luminants or devices to which it pertains. The system that has thus far prevailed, of trying to maintain an equitable balance of commercial exploitation between the different manufacturers, will never establish illuminating engineering in the confidence of the public, nor of architects and independent consulting engineers; nor will it even serve the best interests of the manufacturers themselves. The value of a statement from its advertising or commercial standpoint is not so much the fact stated as the extent to which it is believed. All the information in the world, even though it is as reliable as the law of gravitation, will avail nothing if it is not accepted by those for whom it is intended. The only way to make information acceptable is to state the truth, and not only to state it, but in such a manner as to carry the proof of its truth with it. The fact that the other great engineering professions, notably the mechanical and electrical engineers, have standardized practice, as brought out in Mr. Godinez's paper, proves that scientific truth is not inimicable to commercial progress. If the Illuminating Engineering Society cannot secure the exact facts in the field with which it deals, and reduce these facts to standards of practice, it has no license to exist; and unless it accomplishes this end it will go to the dogs—the unlicensed ones, too. It may be noted in passing, that there was not a paper on this subject in the convention programme.

Describing the various factors which enter into maintenance, the authors say:

The question of the effect of dust and dirt, which sometimes cause a large part of the service depreciation, has never been given the attention it deserves; there is an opportunity for valuable work in determining the shape of the depreciation curve and the intervals at which lighting units should be cleaned to secure the highest economy.

Too much emphasis cannot be given to the desirability of regular attendance for those illuminants which do not require trimming from time to time. It is essential for satisfactory operation that such lamps and reflectors be cleaned at regular intervals, hence a fixed charge should always be included for this service. Lamps which require frequent trimming are cleaned at the same time, and the cost is included under the maintenance charge.

That the authors do not take the narrow view that all illuminating engineering can be reduced to a set of formulæ, is shown by the concluding paragraph:

The value of an illuminant can not, then,

be measured wholly by arbitrary standards; certain factors must always be considered in their relation to the individual installation. However, the establishment of equitable standards, so far as possible, and the compilation of data on commercial light sources in accordance with these standards is a work which, when accomplished, will be of positive benefit both to the consumer and to the illuminating engineer.

THE EVALUATION OF LAMP LIFE, by P. S. Millar and L. J. Lewinson.

This paper is a careful and fairly exhaustive exposition of the development of the method of evaluating lamp life that has been in practice for nearly twenty years in this country. The weaknesses of this method are pointed out, and a suggestion is made for a substitute method. The following extracts will serve to define the authors' position on the subject.

The 80 per cent. criterion appears to have been adopted originally as a practical measure, based upon the requirements of the situation, rather than as a value arrived at by means of computations of economic life. It can be justified to-day only as such. This statement is based upon the following considerations:

(1) The exact location of the "smashing point" varies with cost of energy and cost of lamp.

(2) The cost per candle-power varies but slightly with increasing hours in the neighborhood of the "smashing point."

(3) A "smashing point" suitable for one type of lamp operating under one set of conditions is not suitable for all other types or sizes of lamp operating under the same conditions.

(4) Slight differences in candle-power which affect the useful life largely are not perceptible in practice.

Briefly, it is proposed that lamps be evaluated in terms of their lumen-hours or candle-hours per watt throughout the test period divided by the hours in such period, the hours to be arrived at by methods discussed hereafter.

The important matter to be decided before the proposed method evaluation can be applied in the selection of a test period. For any one size and type of lamp the test period should be adopted after careful consideration of normal performance. It should cover the useful portion of the life and should be so selected as to serve the purposes of the parties interested in the test. Where no superior basis of judgment offers, it is suggested that the test period be the average of (1) the hours at which the candle-power of surviving lamps has declined 20 per cent., and (2) the hours at which the mortality aggregates 20 per cent.

Having arrived at a test period by this method, it is proposed that the lumen hours or candle-power hours of the lamp during the period be divided by the hours in the period, and that the resultant mean value throughout the period be considered the measure of the value of the lamp throughout useful life. On this basis a lamp which failed half way through the test period would be given substantially half value. The measure so obtained would be a true measure of the performance of the lamp (neglecting watts) and would be as nearly a true criterion of the value of the lamp as the correctness of the selection of the test period might permit.

The authors have made extensive use of the conventional method of evaluating the "useful" life of lamps. They recognize fully that this method is a logical and consistent application of the 80 per cent. criterion, wherever that criterion is held to be applicable to the performance of individual lamps. Some two years ago the tendency of this method to mislead began to be apparent, and since that time they have in many cases supplemented statements of "useful" life and candle-hours by statements showing for certain arbitrarily selected periods the mortality and candle-power of survivors. Often the extent of the error involved in the standard practise has been sufficient to mislead regarding the relative merits of competing products or of different types of lamps. Due to such difficulties, it seems wise to abandon a strict application of the criterion to the performance of individual lamps and, without abating adherence to the criterion, apply it to the normal performance of each class of lamps in order to determine a test period.

As these proposals are somewhat at variance with well-established practise, it would be unwise to advocate any immediate change in method. Thorough scrutiny and discussion are first in order. Whatever the outcome of such discussion, the authors venture to express the hope that such change in practise as may be founl desirable may be so effected as to continue the useful life idea without involving the practise in the unsatisfactory methods which are now standard.

PHOTOMETRY OF LARGE LIGHT-SOURCES, by G. H. Stickney and S. L. E. Rose.

In this paper the authors describe the methods of photometry and apparatus used in the Photometric Laboratories of the General Electric Co., at Lynn, Mass., and Schenectady, N. Y. The apparatus is illustrated, and the descriptions are clear and concise. The matter has only a collateral interest for the majority of illuminating engineers, and such as are interested will prefer to read the entire paper.

PHOTOMETRY AT VERY LOW INTENSITIES, by Dr. Louis Bell.

The author states that he was led to the investigation of this subject as a result of his work in the photometric measurement of street illumination, where intensities of less than one meter-candle have frequently to be dealt with. The subject is handled in a thoroughly scientific manner; a review of the work previously done along these lines being first given. The results of the investigations carried on by the writer show that a remarkable degree of accuracy in reading intensities under one meter-candle can be secured by shielding the eyes from all light for a considerable period of time before making the photometer readings.

With fairly good dark adaptation, i. e., by shutting out all light from the eye for fifteen minutes or longer, it was found possible to read, with the usual accuracy, intensities down to a few hundredths of a meter-candle. Without such dark adaptation the readings are very unreliable. Where low intensity is to be measured therefore it is absolutely necessary to adapt the eye in this manner before making observations, if accuracy is to be secured.

The Effectiveness of Light as Influenced by Systems and Surroundings, by J. R. Cravath.

The thesis of this paper is best set forth in the opening paragraph:

The efficiency of various artificial lighting systems is frequently expressed in the percentage of the total lumens generated which reach a given working plane. Such information must always be of fundamental importance and it should be the constant effort of the illuminating engineer to get more. However, it has been recognized for some time that the illuminating engineer must go a step farther and study the relative effectiveness or efficacy of the lumens delivered by different methods and with different surroundings as well as with different individuals. To put the problem in another way, will a foot-candle of illumination intensity delivered on a given part of a working plane be as effective in enabling a person to see clearly under one set of surroundings and conditions as under another? How is visual acuity aeffcted by the color and illumination of surroundings, by glare from lamps in the field of vision, by glare or shadows on the work, or by personal peculiarities? A high efficiency avails nothing if it is accompanied by such characteristics as make vision uncomfortable or inconvenient. These questions have a very practical bearing on the design and arrangement of illumination systems in every day practice.

As an essay toward the solution of these problems the writer carried out a series of experiments in a room about 20 ft. square. Five outlets were symmetrically placed in the ceiling, and these were supplied with various combinations of direct and indirect lighting units. The purpose of the test was to obtain the usual effect, or efficiency of the two systems. The test consisted in the observer reading a page from the Saturday Evening Post, the paper being laid flat upon the top of the desk. Illuminometer readings were made at this point with the various kinds of illumination. The intensity of the illumination on the page was varied by means of a rheostat and the observers were required to note the point at which they considered the intensity sufficient for comfortable, steady reading, and also when they considered it ample. The results are given in the following tables:

Table of Foot-Candles Considered the Minimum Comfortable for Steady Reading.

Name of subject.	Test number 3	4	7	8	9
Miss B. Hennessy	0.47	0.46	0.73	0.42	0.62
Albert Scheible	0.80	0.57	1.29	0.92	4.58
O. H. Caldwell	0.47	0.42	0.27	0.18	0.30
J. R. Cravath	0.89	0.91	0.92	1.12	2.00
Walter E. Lent	0.60	0.55	0.99	0.42	0.50
J. B. Jackson	0.47	0.45	0.68	0.30	0.50
S. E. Church	0.53	0.42	0.42	0.23	0.41
A. A. Keene	1.53	1.48	...	...	...
F. J. Pearson	2.23	1.38	1.73	0.69	*7.27
W. R. Bonham	0.59	0.66	0.49	0.19	0.44
Dr. Nelson M. Black	...	...	1.47	1.35	*0.69
H. D. Butler	0.64	0.46	0.85	0.44	1.45

* Less than 10 readings taken.

Table of Foot-Candles Considered Ample.

Name of subject.	Test number 3	4	7	8	9
Miss B. Hennessy	0.76	0.72	1.37	0.735	2.43
Albert Scheibel	1.28	1.03	2.37	1.92	11.96
O. H. Caldwell	0.80	0.81	0.58	0.39	0.69
J. R. Cravath	1.34	1.30	1.35	1.76	3.30
Walter E. Lent	1.39	0.99	1.68	0.69	0.93
J. B. Jackson	1.17	1.16	0.68	0.85	2.26
S. E. Church	0.87	0.68	0.68	0.39	0.77
A. A. Keene	2.06	2.12	...	...	...
F. J. Pearson	3.09	2.07	2.59	1.09	*10.02
W. R. Bonham	1.12	1.13	0.94	0.42	0.76
Dr. Nelson M. Black	...	...	2.68	2.37	*1.81
H. D. Butler	1.33	0.93	1.54	0.74	3.00

* Less than 10 readings taken.

Test No. 3. Indirect at center; desk in center.
Test No. 4. Direct in corners; desk at door.
Test No. 7. Direct in center; desk in center.
Test No. 8. Indirect in corners; desk at door.
Test No. 9. Shaded direct light; surroundings dark.

The author's conclusion is as follows:

The general conclusions to be derived from these tests and previous information are that under ordinary working conditions the diffuse character of the light falling on the work has more influence on the comfort of seeing and the amount of required il-

lumination than the brightness of the surroundings. The greater the percentage of diffuse or indirect light and the less the percentage of direct light from small sources, the more satisfactory the system is likely to be for work under varying practical conditions. These conclusions apply only to conditions where there are no exposed lamps within twenty-six degrees of the center of vision, when the eye is centered on the work, because the brightness of lamps so placed doubtless causes annoyance and necessitates increased light on the work. Extreme brightness of surroundings with a diffusing lighting system may be produced experimentally, which will necessitate high illumination on the work; but for economical reasons such extreme conditions are not likely to be common as they would be costly and troublesome to produce commercially. On account of the impossibility of properly diffusing the light to secure comfortable illumination on the work, with dark surroundings, under ordinary conditions of use, the glare from the work practically more than counteracts any gain in visual acuity in having surroundings dark.

Judged by the length and spirit of the discussion this was the most important paper presented at the convention. The subject of direct versus indirect light has been the bone of contention among the members of the society ever since the latter system began to attract public attention, and no effort was spared to show up weakness in the methods of test and the results obtained in this case. This in itself has a decided advantage in the case of any scientific paper reporting the results of experiments. The scientific spirit is merciless in its methods and is no respector of persons. The truth can be secured only by the most careful search for errors and their elimination from the results.

Aside from the evidence furnished by the discussion, moreover, this paper indicates the line along which investigation must be made before illuminating engineering can be reduced to any definite standards of practice. Theories are useful only to the extent which they indicate the lines along which experiments must be carried out, and they must absolutely stand or fall by the results of investigation. There has been plenty of theorizing as to the conditions of illumination best suited for different purposes, but of actual proof up to the present time there is almost none. As we have frequently remarked before, the ultimate purpose of illumination is to enable the eye to perform its proper function, and the merits or demerits of any particular system must be finally judged by this effect. The evidence of those using their eyes is the court of last appeal, providing only that a sufficient number of cases be observed to reduce the personal error to a minimum. It is to be hoped that the example set by Mr. Cravath will be largely followed during the coming year, and that reports of vital interest to the profession will be made at the next convention.

The Distribution of Luminosity in Nature, by Herbert E. Ives and M. Luckiesh.

The questions which the authors set before them are thus given in the opening paragraphs:

There is little dispute that in natural daylight illumination, out of doors, one finds some of the most pleasing distributions of light. There can also be no question that the human eye has by adaptation become most accustomed to these distributions, and finds in them its most healthful activity. It is still, however, an open question whether under the practice of continuing human activities into the night—a practice comparatively new in terms of the history of the race —the same character of illumination conditions as in daylight are best. Or ought artificial light indeed be markedly different in composition and distribution from natural light? Only experience and refined physiological methods of testing can settle this question. However, the generally admitted fitness of daylight conditions to the eye has made the natural light of the sun and sky a rather frequent standard to which artificial systems are compared. Thus a purely indirect system finds adherents because it simulates the extended bright sky; localized lighting gives the directed shadows of sunlight, and combinations of the two imitate more or less closely the partly directed and partly diffused light of day.

Now, whatever one's opinion, or the ultimate weight of evidence as to the advisability of imitating daylight at night, it is nevertheless of interest and importance to know with some definiteness what the pleasant daylight conditions actually are. That done, it will be possible to imitate them artificially with probably greater exactness than do any present installations which frankly claim similarity to daylight distribution as one of their advantages.

As one method of attacking the problem, a series of photographs was made of

various landscapes and views which produced an effect either pleasing or disagreeable to the eye, and by an ingenious method of averaging the surface brightness of different objects in the photograph general observations of the three different elements of a view, namely, sky or distance, middle-ground and foreground, were made.

The general conclusions drawn from the observations are as follows:

> Generalizations from so few cases are difficult; many are not warranted. A few facts, however, seem to show clearly. One is that the eye will tolerate a greater brightness and flux of light above the horizontal than below. On the other hand the case of the overcast sky shows that the eye will not tolerate too great a flux above the horizontal. The fact of the matter seems to be that the unpleasant feature in each case is the presence of large areas of nearly uniform high brightness. The eye can tolerate such a condition in the case of the sky, but it cannot tolerate uniform high brightness in the foreground. In the case of the overcast sky the extended bright area of the sky does not appear to be pleasant, in apparent contradiction to the statement just made. The explanation seems to lie in the fact that in the sky here is considerable variety of light and dark due to foliage and clouds. In fact, as noted in the discussion of long shadows, the difference between pleasant and unpleasant conditions seems to lie chiefly in the presence or absence of variety. In the best landscapes studied by us the ideal condition seemed to be a preponderance of brightness in the sky, with a foreground showing marked varieties of light and shade, occasioned by the direct light of the sun falling rather obliquely. The diffused light of the sky alone is apparently not intense enough or properly directed to be of itself satisfactory for illuminating the foreground in the presence of an unbroken area of bright sky.

The subject investigated as well as the methods of investigation are unique and original and point the way for much useful work in the future.

The Law of Conservation as Applied to Illumination Calculations, by A. S. McAllister.

The title of this paper suggests two meanings: that there might be a method of conserving human labor in shortening the methods of calculation, and that the law of conservation of energy might be utilized in deriving such formula. Dr. McAllister has accomplished both purposes in his efforts, although it is in the latter sense that he uses the term.

The subject is discussed from the mathematical standpoint, higher mathematics being used to demonstrate the correctness of his results, which he obtains by a simple graphic method which requires only ordinary arithmetic for its operation.

As it is impossible to abstract a mathematical demonstration the reader who is interested is referred to the paper.

Resume of Legislative Enactments on Illumination, by E. Leavenworth Elliott.

As the title states, this is a synopsis of the regulation of illumination by law so far as it exists at the present time throughout the world. The present conditions in this country are given as follows:

> There are only eleven states that make any mention of the subject of light in their general factory or labor laws, and in not one of these are the provisions sufficiently specific to render them of practical value.
>
> Connecticut provides that factories be "well lighted," and that colored and corrugated windows may be removed if injurious to the eyes. Illinois requires halls, stairways, etc., to have lights kept burning whenever the building is in use. Maryland requires factories to be "well and sufficiently lighted." Michigan requires foundries to be "reasonably well lighted throughout working hours," and grinding and polishing cannot be done in basements unless sufficient light, heat, and ventilation are provided, as prescribed by the factory inspector. In Missouri, Rhode Island, Ohio and New Jersey, if the Commissioner of Labor, or inspector, finds the heating, lighting, ventilation, or sanitary arrangements dangerous to health, he is to give notice to make necessary alterations. New York and Oklahoma require workrooms, halls, and stairways leading to them, to be properly lighted. Pennsylvania has the same requirement, together with the provision, giving the inspector power to require alterations where lighting is not sufficient.

It is a rather curious fact that Holland alone of all the countries of the world has a definite specification regarding illumination in its factory laws, Belgium coming next in point of definiteness.

Reference is made to the possibility of organized labor taking up the question of illumination as evidenced in the cloak and suit industry in New York. The author states that the two requisites to definite

legislation on the subject are the formation of standard requirements, and the production of a fairly cheap illuminometer which should be as portable as an ordinary kodak and capable of giving results within 5 to 10 per cent. of accuracy.

The American Association for Labor Legislation and the American Association for the Conservation of Vision are interested in promoting the legislative requirements for industrial lighting.

ILLUMINATION OR EQUIPMENT, by Frank B. Rae, Jr.

This was the last and shortest paper presented. The writer frankly states that he is not an engineer, but an advertising man who has had occasion to promote, through the usual advertising channels, various lighting appliances. He takes the engineers to task for not furnishing data comprehensible to the laymen, or in a form which can be manipulated by the untechnical user. He says:

> The difficulty, as it appears to me, is that the true engineers are overly interested in engineering for its own sake rather than for the sake of the public. Realizing their superiority (in this single subject) their effort is to rise further from the mass of humanity rather than to assist humanity to reach their level.

This indictment of engineers is not borne out by the facts in the case. An engineer is a specialist; in other words, he has studied some particular branch of the application of science whereby he has attained special knowledge and proficiency in that particular field. He serves the public best when he is farthest from them in point of special knowledge; the more complete his special knowledge the better engineer he is. The public are not interested in his methods, but only in results. This is true of all professions. You do not require that the surgeon shall tell you just how an operation is to be performed so that you can understand it; what you ask of him is that he shall be able to perform it himself with all possible skill. If illuminating engineering contained nothing more than a few facts which could be tabulated for general use it would not be a branch of engineering. The very fact that the conditions and effects entering into the problem of lighting are so diverse as to require special training and knowledge gives rise to the profession and science of illuminating engineering.

"The unregenerated ad-man" should content himself with setting forth generalities in a manner that will convince his public, and leave the handling of scientific problems to the specialists in the various branches.

Electric Vehicle Association of America

At the convention of this association, held in New York October 10, Mr. J. G. Henninger presented a paper on "The Lighting of Garages." After briefly outlining the general principles of illumination, the writer pointed out the necessity of having ample outlets whether the garage is large or small. The illumination should be such that hand lamps are unnecessary except for the inspection of the interior of the car, or for specially close work. The paper was illustrated with diagrams showing wiring plans, and was illustrated with stereopticon slides.

Pacific Coast Gas Association

The nineteenth annual convention of this association was held in Oakland, Cal., September 19. Among the papers presented was one on "Early Gas Lighting," by W. R. Morgan. The text of the paper has not been received for review.

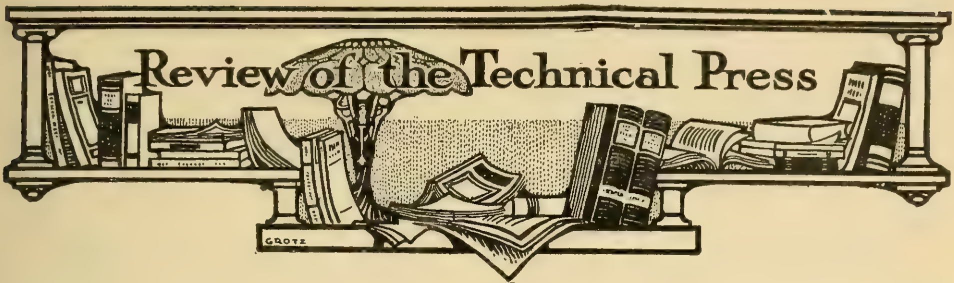
National Association of Cotton Manufacturers

At the semi-annual meeting of this association, held in Manchester, Vt., September 27 to 30, Mr. J. M. Smith presented a paper on "Practical Considerations in Cotton Mill Illumination." A full review of the paper will be given in our next issue.

Colorado Electric Light, Power and Railway Association

The ninth annual convention was held at Glenwood Springs, Colo., September 15 to 19. Mr. S. E. Doane presented a paper on "The Economical Production of Light."

Mr. Doane treated the subject chiefly from the commercial standpoint, with special reference to systems of charging for electric current, treating the subject along the lines followed in his previous contributions to the question.



American Items

ARGUMENTS FOR CURB LIGHTING; *Electrical World,* September 30.

INDIRECT LIGHTING OF A DOMED AUDITORIUM; *Electrical World,* October 7.

VISUAL ACUITY AND LIGHT OF DIFFERENT COLORS, by J. S. Dow; *Electrical World;* October 14.

This article is a general review of this highly important subject which has been receiving particular attention of late, the contributions by Dr. Bell and Mr. Luckiesh being particularly valuable. Mr. Dow has perhaps given more study to this particular subject than any other investigator, and he sets forth his opinions and the results of his experience with rare clearness and accuracy.

"Grant that owing to the chromatic aberration of the eye the most perfect definition should be secured by monochromatic light," says the writer, "the question remains, Which color?" He then proceeds to answer the question as follows:

I believe that it is not possible to say that light of any particular color is invariably the best for all purposes. The question is a complicated one. The peculiarities of the retina and the intensity of illumination employed affect the problem, but the most important item in the author's experience is whether near or distant vision is employed. Assuming that yellow rays are brought to a focus on the retina the violet rays will be focused in front of it and the red rays behind it. Under normal circumstances, therefore, one might suppose that the eye would accommodate itself best to yellow light and that this color, besides yielding the greatest luminous efficiency, would also yield the most perfect definition. At medium distances, when the eye is neither being forced to accommodate for a very near object nor strained to accommodate for a very distant one, and for a truly normal eye, this might possibly be the case.

But suppose that the eye is forced to undertake very near vision, say within the minimum distance of distinct vision of 10 in. A point is soon reached when the eye-lens is unequal to further effort and the luminous image tends to be formed *behind* the retina, so that one cannot see distinctly. Now it is clear that as this image recedes the red will fall behind the retina first, then the yellow and only afterwards the violet. Consequently, it may happen that we can secure good definition by violet light when we have ceased to do so by light from other parts of the spectrum. This is exactly in accordance with the author's experience and that of some other people who have worked with him on this point. With a pure blue-violet light the eye can be brought to within a few inches of the object viewed without the strain of accommodation becoming noticeable. It is a fact that the green end of the spectrum is known to be excellent for securing good definition in microscopic work. This is usually ascribed to certain physical phenomena connected with the optical laws of this instrument, but it has always seemed to me that the chromatic aberration of the eye might also be a potent factor.

This matter is a somewhat important one. The tendency of most people who have a difficulty in seeing fine work is to bring the eyes nearer and nearer, thus gradually straining the lens and leading to short sight. The defective vision of watchmakers and lacemakers is well known. Is it possible that by using violet light the effort of accommodation and the consequences of such persistent near work might be mitigated?

Next picture what happens as the observer moves backward. A position is soon found when the eye can accommodate with perfect comfort for ordinary light—that is, mainly yellow light—and it might be presumed that in this case improved definition would be secured by using only this part of the spectrum. The red and violet ends naturally cannot be focused simultaneously with the yellow and only contribute a luminous haze.

As the distance becomes greater the effect

becomes more pronounced, so that the eye oscillates between these two states. This experience, however, is not enjoyed by the author, whose eyes are slightly shortsighted. His experience is that at distances of upward of 20 ft. it becomes more and more impossible for him to focus blue at all, while objects illuminatel by red light appear more definite and sharp than even white ones would do.

Regarding the relation of photometry, and more especially heterochromatic photometry, to acuity of vision, the writer says:

Clearly one cannot make successful use of a method according to which the value of one light might exceed the other, notwithstanding the fact that its illuminating power was thousands of times greater. In short, the power of revealing detail and the power of creating brightness are separate functions, and are better kept apart.

This amounts to a plain statement that where acuity of vision is the prime requisite of illumination, as it is in all cases of industrial and commercial lighting requiring close eye work, considerations of intensity alone are of very secondary value as compared with acuity of vision.

His conclusions, which seem entirely logical, are as follows:

As regards the best qualities of light for distinct vision, the conclusion would seem to be that for very near work the blue end of the spectrum would be found to be best, for moderate distances the central region and for distant objects the red end. It is conceivable that to some exceptional people the color of the light (so long as it were approximately monochromatic would be indifferent. They, however, would not suffer by following the above suggestions, while short-sighted people who appear to find most difficulty in focusing the blue end of the spectrum at a distance would benefit.

Combination Lamp Post Drinking Fountains at Dubuque, Iowa; *Electrical World,* October 14.

Processes for Modifying the Color of Mercury Vapor Lamps; *Electrical Review and Western Electrician*, October 14.

A translation and an abstract from the *La Lumiere Electrique,* August 26, by Jean Escard.

After defining the spectrum of the mercury-vapor arc, the writer points out the advantages of this form of light for practical illumination:

From an optical standpoint this green light has many advantages. It is known that the ocular discomforts of the luminous arcs are a result of the red and orange rays emitted. Numerous demonstrations show that the mercury-vapor lamp which has none of these rays, does not fatigue the eyes and that it has a good influence physiologically and psychologically; its flame is absolutely stable and has none of the fatiguing fluctuations of ordinary arc lamps.

Although the mercury lamps are rich in ultra-violet rays they have a negligible effect on organisms as compared with X-rays. On the other hand experiments on eye fatigue prove that there is no possibility of these rays escaping from the lamp, the glass used being opaque to ultra-violet rays. The pressure in the mercury-vapor tube is, moreover, much higher than that in an X-ray tube.

The color of the mercury-vapor arc, which is very soft and non-irritating, has a beneficial effect on persons who work under the lamp. Workmen not only easily habituate themselves to the new conditions and the odd color of the accustomed objects, but they appear to turn out better work. This fact has been noted in many shops. Moreover, it is known that the eye fatigue and congestion of the eyes resulting from red light irritate and excite the nervous system. On the contrary the green or bluish light rests and relieves muscular fatigue and also has the valuable property of making the form and contour of the objects illuminated as clear as in sunlight.

Also as a feature peculiar to the mercury-vapor lamp, it might be mentioned that it has a penetrating power which is an advantage though it brings in a slight inconvenience. It is first of all advantageous from the standpoint of luminous efficiency. Blue rays have the property of showing less decrease in intensity in a given distance than red or orange rays. At a great distance a greenish light would appear brighter than a red or orange light of the same intensity. This law depends on the fact that the atmosphere is less absorbent for green or blue light than for other colors.

The inconvenience mentioned is one of measurement, and brings up a question as to whether the mercury-vapor lamp can be correctly measured with a photometer using a reddish-yellow lamp. The comparison will be more and more favorable to the mercury arc as the distance between the lights increases.

Such a state of affairs is unfortunately true, and measurements accord exactly with theory. Two monochromatic lights, green and red, cannot be balanced photometrically and a measurement leads only to an indeterminate result. The optic nerve, which is after all the primordial organ of measurement, is more impressed by white light than by any of the colors composing the spectrum, and it responds in different degrees to different colors. Red and green appear different-

ly in any case and results often are of little value to the real intensity of illumination.

The question as to the relative penetrating power of red and green rays has been freely discussed in the foreign electrical journals. The opinion expressed by this writer is at variance with the prevailing ideas in this regard, but are sustained by a number of competent European scientists. His observations in regard to the photometry of the mercury-vapor lamp by comparison of the orange yellow light of the usual standards is worthy of careful consideration.

LIGHTING IN A SYNAGOGUE, by J. S. Colburn; *Electrocraft*, October.

PLAIN TALKS ON ILLUMINATION; *Electrocraft*, October.

This is a second installment of a serial begun in the September issue.

LIGHTING OF A DAVENPORT LOCOMOTIVE WORKS; *Railway Electrical Engineer*, September.

THE GEM LAMP AND WHAT IT OFFERS, by C. W. Berry; *Selling Electricity*, October.

STORE AND WINDOW LIGHTING SUPPLEMENT; *Selling Electricity*, October.

DECORATIVE STREET LIGHTING AS A BUSINESS INVESTMENT, by A. N. Klingman; *Southern Electrician*, October.

DESIGN OF INDUSTRIAL LIGHTING SYSTEMS, by Lloyd Garrison; *Southern Electrician*, October.

THE CALCULATION OF ILLUMINATION AND A GENERAL SURVEY OF CONDITIONS, by E. J. Mora; *Southern Electrician*, October.

THE ELECTRICAL WHITE WAY OF NEW YORK CITY, by B. M. Blum; *Southern Electrician*, October.

DEVELOPMENTS IN INTERIOR, SPECIAL AND DISPLAY ILLUMINATION, by William S. Kilmer; *Southern Electrician*, October.

STREET LIGHTING BY METALLIC FLAME AND ARC LAMPS, by C. W. Bowen; *Southern Electrician*, October.

DUTY OF ELECTRIC COMPANY TO FURNISH LAMPS—VALIDITY OF ORDINANCE COMPELLING IT TO DO SO, by Colin P. Campbell; *Central Station*, October.

THE ILLUMINATION OF FT. GARRY STATION; *Canadian Electrical News* (Toronto), October.

A SINGLE UNIT GAS LIGHT FOR COMMERCIAL LIGHTING, by A. M. Berg; *Progressive Age*, October 2.

FRONT LIGHTING; *Progressive Age*, October 2.

ILLUMINATION—COMPARISON OF LIGHT SOURCES; *Data*, September.

ON "BLAUGAS," A NEW GAS FOR LIGHTING ISOLATED COUNTRY HOUSES AND OTHER BUILDINGS, by Dr. Wm. Paul Gerhard; *Engineering Review*, October.

THE METER—THAT INEXORABLE MECHANICAL ACCOUNTANT BY THE GAS COMPANY; *Scientific American*, October 7.

VISUAL EFFICIENCY, by Archibald Stanley Percival; *The Ophthalmoscope*, reprinted in *The Optical Journal and Review*, October 12.

THE STANDARD OF NORMAL VISION, by Lionel Laurance and H. Oscar Wood; *The Optician*, and reprinted in *The Optical Journal and Review*, October 12.

Editorials

THE INVESTIGATION OF ILLUMINATION; *Electrical World*, September 23.

STUDIES IN LUMINOUS EFFICIENCY; *Electrical World*, September 30.

THE TEMPERATURE FLUCTUATION IN LAMP FILAMENTS; *Electrical World*, October 7.

DIRECT AND INDIRECT LIGHTING; *Electrical World*, October 7.

THE ILLUMINATING ENGINEERING SOCIETY CONVENTION; *Electrical World*, October 7.

VISUAL ACUITY WITH COLORED LIGHTS; *Electrical World,* October 14.

UNSATISFACTORY ILLUMINATION OF FEDERAL BUILDINGS; *Electrical World,* October 14.

IMPROVEMENTS IN FLAMING ARC LAMPS; *Electrical World,* October 14.

THE CRITICAL SIDE OF WINDOW LIGHTING; *Electrical Review and Western Electrician,* September 23.

THE HYGIENIC ASPECTS OF ILLUMINATION; *Electrical Review and Western Electrician,* September 23.

THE ILLUMINATING ENGINEERING SOCIETY'S CONVENTION; *Electrical Review and Western Electrician,* September 30.

SPECIAL APPLICATION OF INCANDESCENT LIGHTING; *Electrical Review and Western Electrician,* October 7.

A SETTLEMENT OF THE LAMP SUIT; *Electrical Review and Western Electrician,* October 14.

METAL FILAMENT LAMPS AND NEW STANDARDS OF ILLUMINATION; *Electrocraft,* October.

BETTER ILLUMINATION; *Southern Electrician,* October.

THE VISUAL ACUITY OF MIXED ASTIGMATISM; *Optical Journal and Review,* October 12.

TWO KINDS OF LOW VISUAL ACUITY; *Optical Journal and Review,* October 12.

KEEN VISION; *Optical Journal and Review,* October 12.

Foreign Items

COMPILED BY J. S. DOW

Illumination and Photometry

DAS CHROMOSKOP, by L. Arons (*E. T. Z.*, July 27).

An account of an ingenious little optical instrument for studying color. The apparatus makes use of polarizing prisms utilized with a suitable slip of quartz to produce a variety of tints. It is stated that any desired tint can be imitated in this way and exactly reproduced. The colors are mixed and not spectrum-pure, but this is claimed to approach most nearly the actual conditions occurring in practice.

CORRECTIONS FOR THE EFFECT OF ATMOSPHERIC CONDITIONS OF PHOTOMETRIC STANDARDS, by W. J. A. Butterfield, J. S. Haldane and A. P. Trotter (Paper read at the International Photometric Commission; *G. W.*, August 5; *J. G. L.*, August 8; *Illum. Eng.*, London, September).

These experiments were carried out on the Harcourt and Hefner flame standards in a special chamber in which the atmospheric pressure the amount of CO_2 and water vapor, etc., could be altered at will, and a much greater variation secured than could be met with in practice. The experiments in general confirm existing data, but cover a wider range and are more accurate. The only deviation of consequence from present accepted results is that the effect of changes of barometric pressure on the Hefner are greater than was previously assumed. The effect of vitiation of atmosphere by the oxygen being used up is fully dealt with and some experiments on gas flames are also described.

HOSPITAL LIGHTING, by J. Darch (Paper read at the Congress of the Royal Sanitary Institute; *J. G. L.*, August 1; *G. W.*, August 5; *Illum. Eng.*, London, September).

The article criticizes the lighting in many existing hospitals, pointing out that ineffective types of shades are employed

and that the lamps in the wards are often so placed as to throw the light directly into the eyes of the patients lying in bed. A special feature is made of the lighting of operating theaters, where a very powerful illumination and light coming from all directions is wanted. The Siedentopf system described consists in the use of a large number of mirrors which reflect the light to and fro in the desired manner.

The Standard Street Lighting Specification, Communications by Dr. H. Krüss and the Austria-Hungary Gas Association (*Illum. Eng.*, London, September).

A series of replies to the inquiries on this subject issued to various Continental authorities and commented upon in prevvious numbers of this journal (August, p. 351).

Photography and Illuminating Engineering, by J. S. Dow and V. H. Mackinney (*Illum. Eng.*, London, September).

The authors point out the value of good photographs of illuminating engineering installations, especially in conjunction with measurements of the illumination. Stress is laid on the great variation in the brightness of objects seen in nature and the limitations of the photographic plate. It is most essential in studying artificially lighted interiors to time the exposure correctly and for this purpose photometry is a great aid. The authors describe the use of their instrument for measuring surface brightness and give a number of views of installations photographed by its assistance.

Methods of Photometric Measurement in Germany, by Eitner; A Suggestion for the Absolute Standard of Light, by H. Strache; A Technical Spectro-photometer, by J. Thovert (Papers read at the International Photometric Commission; *J. G. L.*, August 8; *Illum. Eng.*, London, September).

These three papers are of great interest to photometric experts. That by Eitner is of a general character. Among other matters he suggests that an illumination on the photometer screen of 10 to 30 lux is desirable. He also comments on the need for a quick means of determining mean spherical candle-power. The Ulbright globe is not serviceable for gas lamps as the vitiation of the air in its interior leads to inaccurate results. Strache suggests that an ideal light standard could be made by using a standard incandescent surface, producing its spectrum on a cylindrical lens and cutting down the respective colors so as to get ideal white light in accordance with Lummer's curve of luminous efficiency, and then recombining the elements again. Thovert deals with a very simple spectrophotometer which can be used on an ordinary photometric bench.

Miscellaneous Lamp Characteristics, by M. Tappley (*Elec. Rev.* July 21, 28).

Photometrical Nomenclature (*Electrician*, August 18).

The International Photometric Commission (*J. G. L.*, August 1, 8).

The Standard Street Lighting Specification (*J. G. L.*, July 25).

Holborn Public Lighting. Joint Tender Accepted (*J. G. L.*, August 1).

Bericht der Lichtkommission der Deutschen Verein von Gas und Wasserfachmännern (*J. f. G.*, July 29).

Electric Lighting

Elektricität im Hause, by G. Dettmar (*E. T. Z.*, July 20).

A popular article describing the use of electricity in private houses for lighting and heating.

Electrodes pour Lampes à Arc, by J. Escard (*l'Electricien*, August 12).

The author summarizes recent investigations on metallic electrodes for arc lamps. Although many researches on this point have been carired out there have been few practical applications, the magnetite and titanium arcs being the best examples; iron electrodes are also employed in the Finsen light.

Ueber das Ingangsetzen eines Quecksilberlichtbogens, by O. Kruh (*Elek. u. Masch.*, July 23).

Contains an interesting summary of the processes of starting mercury vapor lamps. The most reliable is the ordinary "tipping" method, which may be accomplished by hand or by the aid of an electromagnetic rocker, but it is difficult to apply the method to lamps in series. Other methods are the use of a momentary high tension electric discharge by breaking an inductive circuit, the use of a subsidiary electrode in starting, an electromagnetically controlled floating contact which is employed in conjunction with a long carbon filament, and radioactive devices. Most of these, however, have proved impracticable owing to the effect of small variations in the internal pressure, which take place with the aging of the lamp, and the influence of temperature.

Verbesserungen in Metalldampflampen (*Z. f. B.*, July 30; August 10).

This article is also devoted to improvements in mercury vapor lamps. One of the points insisted upon by the author is the necessity for some means of preventing the mercury gradually being conveyed over to the negative pole, and a number of patents are described which have for their object the maintenance of a constant level at the positive end.

Drawn Wire Tungsten Lamps and Illuminating Engineering (*Illum. Eng.*, London, September).

An account of a visit to the British Thomson-Houston Works at Rugby, where a special feature was made of the new wire drawn tungsten lamps. The importance was also pointed out of not only securing efficient illuminants, but also teaching consumers to make the best use of them.

Gas Lighting

Inverted Incandescent Gas Lighting, by M. Scholz (*J. G. L.*, July 25).

The article is mainly devoted to a discussion of some figures recently given by Professor Wedding on gas lighting. An interesting announcement is that a German company has succeeded in turning out a low pressure lamp which has an efficiency as high as 40 c.-p. per cubic foot of gas.

Street Lighting by Gas on the Continent (*Illum. Eng.*, London, September).

Contains some statistics as to the growth of gas lighting in Berlin. Until 1905 there were only 4½ miles of streets lighted by high pressure gas, but during the succeeding five years 30 streets have been so lighted. There are also a number of views showing the method of suspending gas lamps over the streets on wires in Stuttgart. An interesting method of grading the candle-power of lamps in side streets so as to gradually increase from the darker and more remote portions toward the main thoroughfares is also mentioned. The object is to prevent a sudden contrast in light and darkness as the main street is entered.

Das Gleichstromprinzip beim Invertbrenner für niedrigen Druck, by G. Schuchardt (*Z. f. B.*, July 20).

The author discusses the effect of the impinging upward stream of air on the mixture of gas and air flowing out of the inverted burner. He thinks this effect undesirable and describes a burner which by an abundant supply of primary air prevents the necessity for this "counter stream" taking place.

Gas and Electric Street Lighting in Berlin (*J. f. G.*, July 15; *J. G. L., G. W.*, August 5).

Gas for Railway Carriage Lighting (*G. W.*, July 22, August 19).

Neuere Brenner für flussige Brennstoff (*Z. f. B.*, July 30).

High or Low Pressure for Shop Lighting? (*G. W.*, August 19).

Contractions used:
Elek. u. Masch. Elektrotechnik und Maschienenbau.
E. T. Z. Elektrotechnische Zeitschrift.
G. W. Gas World.
Illum. Eng. Lond. Illuminating Engineer (London).
J. f. G. Journal für Gasbeleuchtung.
J. G. L. Journal of Gaslighting.
Z. f. B. Zeitschrift für Beleuchtungswesen.

The Illuminating Engineer

Vol. VI DECEMBER, 1911 No. 10

TAXES

"In This World Nothing is Certain But Death and Taxes."

FRANKLIN.

Against both of these certainties civilized man has always rebelled; and for the prospect of deferring or mitigating them man will go to the length of perjuring his immortal soul. From death there is no escape, and from the payment of taxes but one alternative, a return to savagery. Taxes are as inevitable a concomitant of civilization as death is of life.

But the taxes we pay are by no means limited to those collected by the State. To further quote the practical and philosophical Franklin: "Idleness and pride tax with a heavier hand than kings and Parliament." And again, "Time is money." Were a manufacturer to be assessed ten per cent. on the value of his product by the State he would consider that his business had been confiscated, and that his only recourse was a receiver. Yet he will submit to a taxation of twice this amount levied by his ignorance of the relation of light to operative efficiency, without a murmur, in fact, often with an inward sense of appreciation of his own shrewdness in "keeping down expenses," by which he means keeping down expenditures. Between expenses and expenditures there is as wide a difference as between profit and loss: the expenditure that results in greater efficiency of labor is not an expense but a profit.

The merchant will groan under the burden of a one per cent. tax for the support of government, and tax himself tenfold as much with cheerful self-complacence by his failure to exhibit his wares under the most favorable conditions of illumination.

The householder will contest the payment of a five-dollar lighting bill, and deny himself an hour's time to study the question as to the best methods of using the illuminant paid for.

The trustees of a public library or institution will follow the dictates of their pride in lavishing money on Greek columns on the outside and marble pillars in the entrance, and reject without a qualm of conscience the services of an illuminating engineer on account of the insignificant tax upon the whole structure represented by his fee; with the result that the usefulness of the building is irreparably hampered by faulty and inadequate lighting.

The taxes which we willingly accept by reason of ignorance, prejudice, and mistaken pride are indeed more burdensome than any that the most corrupt and extravagant State ever dreamed of imposing upon its citizens.

LET THERE BE MORE AND BETTER LIGHT!

E. L. Elliott.

Busy Boston by Night

Glimpses of Some of the Best Known Spokes of the Hub Under Electric Light

In the dark age, prior to the advent of the electric light and the trolley car, Scollay Square was the exact hub of the universe, being as near as the eye can estimate the geographical center of Boston, as well as the starting point to all the far and near sections and suburbs of the city. While the new subway has somewhat modified this famous intersecting point, it still retains much of its original character. There is probably no spot on the American continent which is so thickly surrounded with buildings and locations of historic interest as this irregular open space. Revolutionary landmarks cluster around it like theaters around Times Square, New York, and it has seen every form of street lighting, from the watchman with his tin lantern to the modern series luminous arc lamp with which it is now illuminated, and every means of public conveyance from the ox cart and stage coach to the electric subway, the handsome station of which shows at the right. We will not repeat the stereotyped phrase of "night turned into day" by the modern electric illumination; the exaggeration is too great to make it serviceable, even as a rhetorical flourish. As the illustration shows, however, the illumination is practically uniform, and of such brilliancy that one can readily read a newspaper in any position. It is not daylight, which would become well-nigh unbearable on account of its monotony if it were with us twenty-four hours a day, but an exhibition of modern street illumination which makes the thoroughfare as serviceable by night as by day, and adds to it the charm of variety and change. A street has a certain beauty, or interest, by day and another by night, and the latter may be the more interesting and pleasing of the two.

Not less rich in historic setting nor less thronged with hurrying crowds is the corner of the famous Boston Common, shown

FIG. I.—SCOLLAY SQUARE, ONE OF THE PRINCIPAL CENTERS OF STREET CAR TRAFFIC.

FIG. 2.—A BUSY CORNER OF THE COMMON, OPPOSITE THE STATE HOUSE.

in Fig. 2. The capitol-crowned Beacon Hill, itself crowned with a dome of gold, brilliantly set out against the sable background of the sky with a thousand electric lamps, shows in the center of the scene, with the conspicuously modern subway station at the left, and the historic Park Church at the right. The illumination here is by series luminous arc lamps, as in a previous view.

At the other end of the Common, where Tremont street crosses Boylston, is another of Boston's busy corners, shown in Fig. 3. In this view we are looking down Boylston street to Washington. At the right, just beyond the series luminous lamp, is the Touraine, the best known of Boston's newer hotels. On the corner at the left is the Masonic Temple, just beyond which is the handsome building of The Edison Electric Illuminating Company of Boston.

Running as nearly parallel to Tremont street as can be expected of a Boston street, Washington street, within the distance corresponding to the length of the Common, contains the principal retail section, and is one of the most crowded thoroughfares in the world. Boston has never aspired to, or claimed a "Great White Way." The section of Broadway, New York, to which this title was originally applied has characteristics which punctilious Boston would not care to publicly admit. Some wag has said that the Great White Way is not only a place where lights glitter, but where the people themselves scintillate, and, of course, such a thing could not well happen in the American Athens. The stretch of Washington street mentioned, however, is the Boston version of the Great White Way; for here are not only brilliant street lamps, but electric signs, illuminated windows, and the other uses of the electric lamp which are characteristic of the White Way idea.

Fig. 4 is a view looking south from Hayward place, and Fig. 5 another view looking south from the Adams House, showing some of the brightest portions of this section.

Copley Square is a spot of which Bostonians are justly proud on account of the

handsome and well-known buildings with which it is surrounded, as well as for the general beauty of the section. In the foreground is the magnificent Public Library, which is one of the choice libraries of the world. At the left-hand corner, just cut off in the photograph, is the church made famous by the pastorate of Phillips Brooks. The illumination in this square is by vertical carbon flaming arc lamps on standards 60 ft. high; and it is claimed, undoubtedly with much truth, that this is the best lighted public square in America.

Whoever has heard of Boston has heard of Commonwealth avenue, which is undoubtedly the most aristocratic residence street on this continent, not excepting Fifth avenue, New York. Besides its aristocratic proclivities, it is also one of the handsomest thoroughfares in the world, in this respect far excelling Fifth avenue, except that section which is opposite Central Park. As shown in the illustration, Fig. 6, the street is really a parkway with a broad stretch of shaded lawn in the center. This is now illuminated with series luminous arcs, and presents a brilliant spectacle by night, as the photograph shows. As a matter of engineering information it may be stated that these lamps consume 6.6 amperes an hour and are operated from series mercury arc rectifiers, supplied with current from Brush arc machines. The flaming arc lamps are of similar capacity and are operated on the same series circuits.

With its New England sense of truth Boston does not claim to be "the best lighted city of its size in America," but only *one* of the best lighted, and to this conservative claim no one familiar with either the city or the surrounding territory will think of taking issue.

It was one of the first cities to make large use of the series luminous arc lamp of which it now has in regular service something over 4,000. In fact, it is due in no small measure to the constant efforts of this company to give the best possible value for the money in its public lighting service, as demonstrated by its selection of this new form of electric arc for the regular lighting of Boston streets at a time when it was hardly out of the development stage, that there are at the present time more than 75,000 lamps of this character in use throughout the country to-day.

FIG. 3.—THE OTHER END OF THE COMMON, LOOKING TOWARD WASHINGTON STREET.

FIG. 4.—A SECTION OF THE WASHINGTON STREET SHOPPING DISTRICT.

The vertical carbon flaming arc lamp likewise received its first commercial demonstration in this city. In the matter of public lighting, therefore, Boston has been the progressive—even the adventurous leader which the Western cities have followed—an exact reversal of the popular idea of Eastern conservatism and Western progress.

To speak in still more general terms, Boston was one of the first cities to make use of the electric light for interior and exterior use, a small isolated plant for this purpose having been installed in 1881, which was before the commercial advent of the incandescent lamp. The Edison Electric Illuminating Company of Boston which now supplies electric current to Boston and a large outlying district was organized in December, 1885, and has grown up with the industry from almost its first beginnings. To an organization of investors who had the broad-gauge intelligence and foresight to engage in an industry that was still scarcely more than a brilliant idea

FIG. 5.—ANOTHER VIEW OF BOSTON'S "WHITE WAY."

that had been given only experimental demonstrations, it would be natural to look for not only commercial success but a permanent place among the most progressive and advanced exponents of the art. Such an assumption is entirely in accordance with the facts. No central station in this country has been more alert in welcoming new devices and improvements pertaining to the subject of electric light and the other commercial applications of electricity.

When the tungsten lamp was first put upon the market its enormously increased efficiency spread consternation among the purveyors of electric current; they saw

FIG. 6.—COMMONWEALTH AVENUE, THE PRIDE OF BOSTON'S RESIDENTIAL STREETS.

in this improvement only a source of decreased revenues. Illuminating engineering as a science and profession secured a foothold just at the beginning of the recent improvements in light-sources, and this was likewise viewed askance by many of the lighting interests at first, since its chief claim to attention was the production of illumination with less waste and greater efficiency. But this was not the view taken by The Edison Electric Illuminating Company of Boston. On the contrary, it took the exceptionally far-sighted view, and not only accepted both the physical improvements in electric lamps, but the further economies offered by illuminating engineering; and not only did it accept these conditions, but inaugurated an expensive and forceful campaign of public education, chiefly through the medium of advertising in the daily press of the city, to make the position of the company clear to the public.

Briefly stated, its position was this: improved electric lamps reduce the consumption of current required to produce a given amount of light more than one-half; the only method of offsetting this reduction of the individual customer is either to secure additional customers, or a greater use of light by present customers. As a foundation for such extension the company proposed to give the best service possible at the lowest possible rate. As a matter of fact, substantial reductions in the rates for current were made in the face of the economies produced by the new light-sources and illuminating engineering.

A department of illuminating engineering was established, the services of which were offered gratis to customers; and this illuminating engineering department was no mere advertising scheme based upon fictitious engineering ability. On the contrary, a corps of the most able engineers available was secured, and the department was put upon the highest possible professional and scientific plane.

The results have justified the position taken by the company, which has steadily increased both the amount of its business and its revenues.

The large measure of success of the Boston Edison Company, as it is familiarly known, furnishes a most instructive lesson on the practical, commercial advantages of not only falling in line with the march of progress, but in taking a position at the head of the column. The company has invariably stood for scientific progress and an enlightened and fair treatment of the public to which it caters, and this policy has invariably been rewarded with financial success.

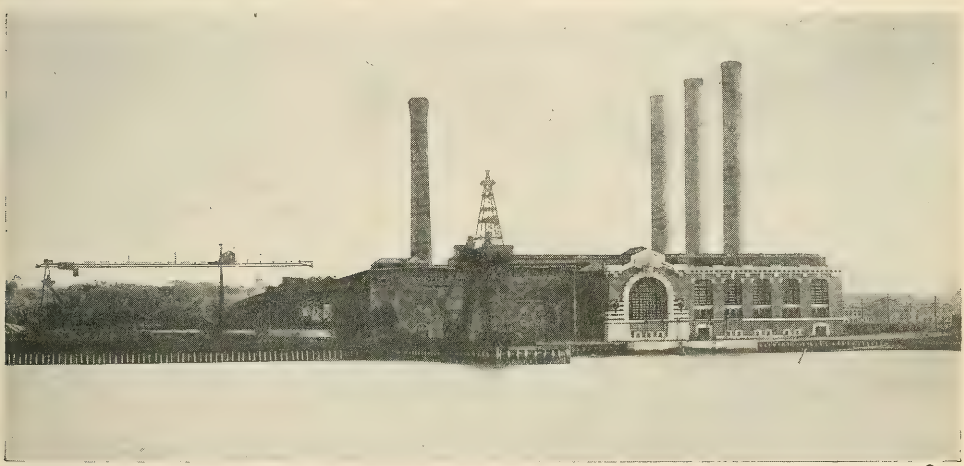


FIG. 7.—SOUTH BOSTON STATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY.

The Ornamental Street Lighting at Poughkeepsie

By A. L. Chapin.

The movement for ornamental street lighting has long been evident in the Middle West, but only lately has it taken hold of the more conservative Eastern towns. The latest newcomer to the ranks of "The City Beautiful" is Poughkeepsie, N. Y., a thriving town of 27,000 inhabitants, which, if the ambition of its public spirited and wide awake citizens is realized, will soon increase to 50,000.

Always on the lookout for some new way to push and advertise the city, the matter of well lighted streets was one of the first to receive attention. It was felt, however, that the streets should not only be well lighted, but also artistically lighted. The local lighting company (the Central Hudson Gas & Electric Company) was consulted and made experiments to determine the best system of lighting. It was found, however, that this ornamental lighting could not be completed by fall, during which time occurred the firemen's convention and the Hudson-Fulton celebration, and it was therefore decided to erect some temporary lighting similar to that of the Court of Honor, which had been used at the inauguration of President Taft at Washington. This was a very beautiful and elaborate affair, consisting of eight massive columns and thousands of incandescent lamps.

As a result of this special lighting the citizens were more enthusiastic than ever for artistic ornamental lighting. The city therefore decided to abandon the idea

FIG. I.—A SECTION OF THE NEW WHITE WAY, POUGHKEEPSIE, N. Y.

of arches and install along Main Street an ornamental post lighting system with incandescent lamps, where formerly arcs had been used. Realizing the unattractive appearance of a great number of wooden poles along the streets, the city bought and erected combination trolley lighting poles and then passed an ordinance requiring all other poles to be removed from the street.

The pole decided upon has an over-all length of 30 ft., with three successive diameters, 7 in., 6 in. and 5 in., and several ornamental collars and an ornamental base 19 in. in diameter. Each one of the four lamp arms is cast separately and then bolted to a semi-circular collar, two of which are bolted together around a small shoulder, which projects from the pole. The poles are set 6 ft. in the ground, filled in with concrete, which runs inside of the pole through a hole purposely left in the casting, and then left for ten days before being subjected to any strain. The poles are painted green, with the exception of the ornamental collars and extremities of the arms, which are aluminum color. The equipment for each cluster consists of four 100-watt Mazda multiple lamps of the drawn wire type, on a 120-volt alternating current circuit; each lamp is pendant, enclosed in a 12-in. opal globe 13 ft. from the ground. Some sand blasted globes were also used, but are being discarded on account of glare.

The method of supporting the lamps is a very ingenious and original device for securing at the same time both flexibility and absence of vibration. When the hollow lamp arm is made, there is cast inside of it and at the end a thin horizontal bar in which there is a small hole directly above the center of the opening, where the lamp socket is to hang. A small chain is drawn through this hole and held by a rod passing through a link of the chain and on the top of the bar. To the other end of the chain are clamped two pieces of wood so as to hold between them at the very extreme ends the current carrying wires leading to the weather-proof socket. In this way a flexible shock absorbing connection is made and at the same time the lamps are fastened directly in the center.

The electrical distribution system is from underground four-run tile duct that was put in about two years ago when the city laid new sidewalks. Current is brought overhead from the power house at 2200 volts, No. 6 wire, to a pole placed in an alley or back yard, but near the main street. The two conductors pass down the pole through two cutouts and inside an iron pipe to meet an underground branch duct, which carries the conductors to the transformer manhole. From the transformer, the secondary, 120-volt, No. 2 rubber covered wire, is carried back to a box on the pole, where it passes through a meter and two fuses (150 amperes each). After being split up into two multiple circuits, with fuses at 65 amperes, it then leads through the controlling two-pole switches to the transformer manhole, where connections are made for each side of the street, two circuits of No. 4 wire being necessary on each side. One set of wires is run underground across the street in an iron pipe up to a junction box, there joining with the distributing mains to supply current both ways along that side of the street. A junction box 30 in. square and about 18 in. deep is placed near each pole, where connections are made for each cluster with No. 12 duplex wire enclosed in a 3-in. pipe.

No trouble has been experienced from water, though the ducts are but 6 in. below the street surface and entirely open to the ends, while the conductors have only their rubber coverings, no cable being used.

The transformers used are of the subway type, 15 kw. capacity, though spaced so frequently as to supply current for only about fifteen poles on each side of the street, a dis-

FIG. 2.—METHOD OF LAMP SUSPENSION.

tance of 1350 ft. This allows an extra load of 3 kw. with each transformer for any special outline or decorative lighting that may be made at a later date, and for the same reason such large sized conductors were selected. The cover for the transformer manhole is forced down tightly upon a rubber gasket, placed on the underside of the cover and made absolutely waterproof by pouring molten pitch over it. Whatever water may soak through the ground is allowed to seep out by a small hole in the bottom, which is not, however, connected with the main sewer, as that is 20 ft. below the street surface. This pitch method of waterproofing has been found entirely satisfactory and, as it costs only about 20 cents per cover, is much cheaper than making a connection with the main sewer.

All the lamps are lighted every night until 12 o'clock, and after that alternate poles until dawn, when they also are extinguished by the patrolman. There are two switches for each transformer, one for the midnight and the other for all-night lamps. The life of the lamps has been excellent, even under the most trying conditions averaging about 1400 hours and standing up under extreme rough handling. Globes have been known to fall down around the Mazda lamps and seldom break them, while in one case the current-carrying trolley pole hit the span wire and broke eight globes, while only two lamps were broken.

The installation was first started in 1910 with but three blocks, but has rapidly been increased, until now there are about 150 posts for a distance of one and a quarter miles. The poles are set every 90 ft. and opposite each other, thus giving 4.4 watts per front foot or 8.8 watts per foot of street lighted. The width of the street is 60 ft. from curb to curb.

The cost of installing each pole was about $70 ($60 for the pole and $10 for the labor). The cost of the four-run duct and iron pipes was $16,949, while the cost of wire and labor for installing was $3,695. The entire cost of the duct should not, however, be charged up to the street lighting, as only one of the four runs is used for that purpose, while nearly all of the pipes were used for the street lighting. If, however, we divide by four the cost of the duct and pipes and add in the entire cost of wire and labor, we shall have the approximate cost of the underground system chargeable to street lighting. The error caused by assuming that only one-quarter of the cost of the iron pipe should be charged to street lighting is approximately balanced by charging to street lighting the cost of laying all the pipes. We have, therefore, $7,932 or $.588 per front foot as the cost of the underground system, which makes the total cost per pole about $123.

The cluster light poles are maintained by the Central Hudson Gas & Electric Company at the rate of $80 per year each for all-night lamps, and $55 per year each for midnight lamps. The approximate cost of the lamp renewals per pole per year is $10 and for labor $1.90. Globe renewals, painting, incidentals, etc., cost about $3 per year.

The installation has proven very satisfactory and the citizens are justly proud of their beautifully lighted streets. One of the well-known advantages of efficient street illumination—the prevention of crime—has been proven by the Poughkeepsie Police Department and the detection of whatever evil doers there may be has been made much easier, as the police officers can see up and down Main street in either direction for three or four blocks. They can, therefore, trace any suspicious character as he moves along or attempts to dodge into a doorway or side entrance. At the beginning a great deal of annoyance was caused by the necessary delay in making and assembling the parts for the installation. The first lamps were installed on one side of the street only and the effect was disappointing, but as soon as the installation was finished for a short distance on both sides, it was a complete success. Thoroughly believing in the advantages of well lighted streets and parks as an aid in increasing the population from 27,000 to the desired 50,000, plans are now being carried out for the illumination of the parks. In fact, it will be only a very short time before Poughkeepsie will be recognized not only as "the largest city of its size in the United States," but also as "the best lighted city of its size in the United States."

Special Illumination from a Tubular Source of Light

By W. S. Kilmer.

VI. Indirect Dining Room and Cafe Illumination.

It is not the purpose of the following article to make any attempt to prove that a direct lighting system is "Light Out of Place," but I do feel safe in stating that if the average commercial illuminating engineer of to-day obtained any such theoretical illumination values as shown at the test stations on Figure 1 he would not consider installing the system and be held responsible for the satisfaction of the client or customer; and in my opinion a direct lighting system under the same conditions, with the source of light in the range of vision, the results would not be satisfactory, owing to the tendency of the average person to look directly at the light source, and by so doing, we all know that the eye cannot adapt itself to the illumination results with any degree of satisfaction.

As will be noticed in Figures 2 and 3, a few soft rays of an artistic nature are included in this lighting scheme from the candelabra shown on the tall uprights. The intrinsic brilliancy of these lights is cut down by the means of soft brown silk below the surface brightness of the ceiling. The object of this is two-fold: it relieves any impression of coldness (which is often encountered in indirect lighting systems), and offers a means of rest to the eye, owing to the color difference.

It will be noted from the values shown at the test stations on Figure 1 that

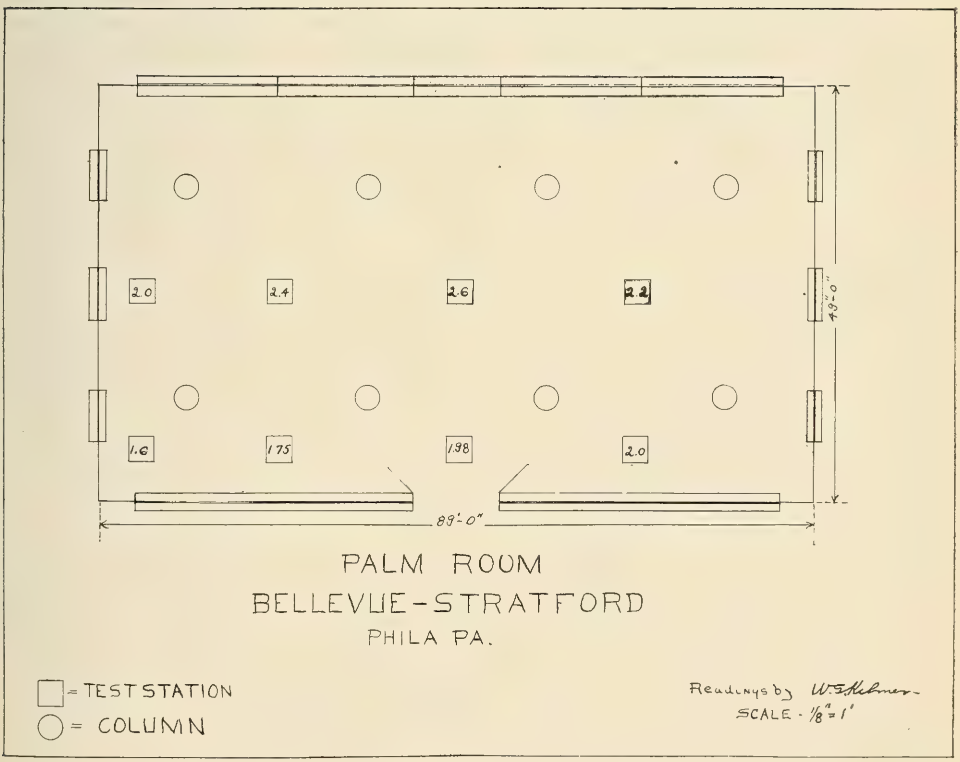


FIG. I.—FLOOR PLAN OF TEST STATIONS.

FIG. 2.—A VIEW OF THE PALM ROOM, BELLEVUE-STRATFORD, PHILADELPHIA, BY LINOLITE INDIRECT ILLUMINATION.

FIG. 3.—THE PALM ROOM FROM ANOTHER VIEW.

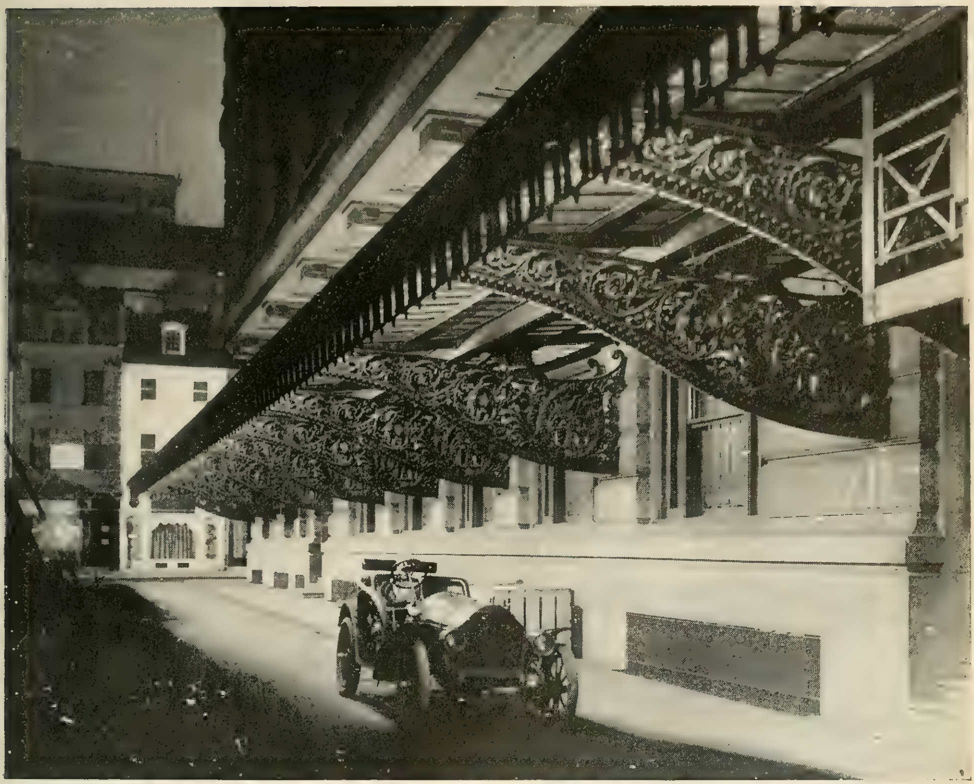


FIG. 4.—LINOLITE ILLUMINATION UNDER THE MARQUEE.

the highest illumination is at the exact central portion of the room, these values decreasing in a partially even manner towards the sides, with a proportional decrease down on the sides towards the ends, the lowest illumination being in the extreme corners of the room. This is a feature desired on most installations of this nature, but often neglected and overlooked. In a cafe or dining area of this nature, patrons are often desirous of obtaining a table space not conspicuous by too much light and publicity. Naturally a location of this nature would be at a remote corner of the space. In cases of banquets and other large functions, the practice is always to place the tables at the center of the room, and in this particular instance an abundance of illumination is received at that point, to care for the seating capacity of that space.

The average ceiling height of this area is 21 feet, with a variation of about 18 inches, owing to the concave lines of the ceiling for the various bays. The finish of the ceiling is a cream-white, broken by a very pleasing series of paintings appropriate to this class of area, in colors which favor the lighting system, namely: light blue and flesh colors. The side walls and other construction details are all finished in terra cotta buff. The chairs are finished in old gold with green velours upholstering. The tables are always, of course, draped with white linen and decorated with the best efforts of the floral artists. This entire combination of colors blends itself with the lighting system into one of the most beautiful effects in artificial lighting which has ever been brought to my attention.

The current consumption was a secondary consideration on the part of the owners of this installation. The foregoing described results must be obtained at any cost, and with this in mind, it is in-

deed interesting to note that this installation utilizes only 3 watts per square foot, or to be exact, a small decimal under that figure, as 520-25 watt tungsten Linolite lamps in 520 feet of specially designed cove reflector was used to obtain the results shown.

The illumination results were measured by placing a photometer on a level with the surface of the tables, also by placing a photometer directly on top of the tables. The difference in the values of these two planes did not show sufficient difference to make any notation of.

To obtain a more distinct idea of conditions above the plane of the tables, the exposures for photographs Nos. 2 and 3 were of one hour duration, taken when daylight assistance was a minus quantity.

Figure No. 4 shows the effect received from a continuous line of the afore described light source in a specially designed weatherproof equipment on the marquee extending around the exterior of this hotel. Uniform illumination is particularly noticeable here, showing all entrances and exits distinct and accessible.

This installation has been in operation since June 1, 1910, and as this test has been made between periodical cleaning periods, the data conveyed to those interested is of a character which may be relied upon for calculations and survey.

Ornamental Street Lighting in Peoria

By T. P. Pinckard.

Before telling you how we got it, let us first tell you what we have and you will then better understand what our problem was and how we solved it.

Our ornamental street lighting system is installed in the heart of the retail district, on a straight, wide street of fairly even grade, that was formerly very well lighted by series arc lamps, two unbroken lines of flat rate window lighting and a multitude of flat rate signs and some outline lighting, all of which remains, excepting the arc system. It extends straightaway for five solid blocks without a break, on each side of the street, and consists of sixty-four Corinthian five-light cast iron posts, bolted to concrete foundations and arranged twelve posts to the block, six posts on each side of the street in each block, all equally spaced 72 ft. apart. This spacing is very satisfactory and places the corner posts on the property line and not at the very corner on the curb line of the intersecting streets. Each post is equipped with four 60-watt and one 100-watt, 105-volt, multiple tungsten wire type lamps in a vertical upright position, burning every night in the year from dusk to midnight and from dusk to dawn respectively, the control being effected in each block separately, if necessary, by electrically operated solenoid switches, the circuit for which is manually operated from the station two blocks away. The glassware is 12-in. and 16-in. Alba globes, Alba glass adding much to the general appearance of this system, especially in the day time. The entire three-wire 105-210 volt cable system on both sides of the street is drawn into fiber conduit laid in concrete under a new curb, which was being placed at the time the lighting system was being installed, and at about the center of each block is connected underground to the manhole in that block of our underground general distribution system, for in this district there are no overhead wires and no other poles than the wires and poles of the street railway system.

The complete ornamental lighting system as described above was installed at the expense of the benefiting property owners and ground floor tenants, at the rate of $2.20 per property front foot, the proportion of this cost that the property owner and his tenant should pay for the frontage involved being left to them to decide, and in some few cases the tenant paid the full amount. Under contract with the city, we furnish current for and maintain the entire system at a flat rate of $50 per post per year.

All of the above sounds very simple

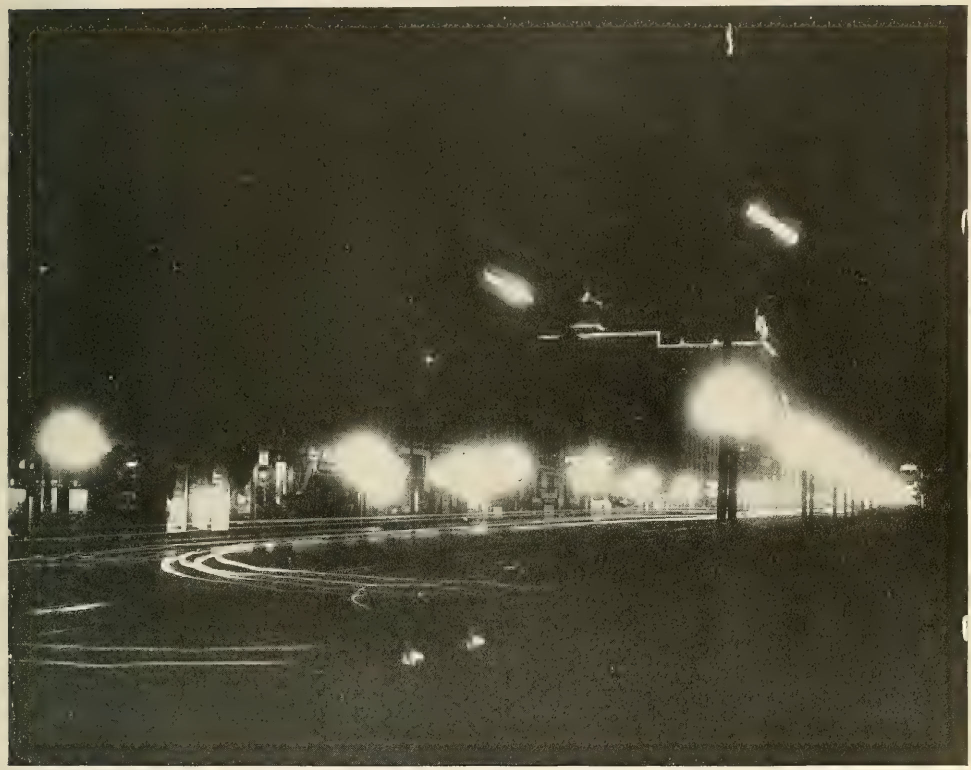


FIG. I.—A SECTION OF THE WHITE WAY, PEORIA, ILL.

and easy indeed, and so it is as an engineering proposition, but even regarding that feature, it is well to secure ideas before laying out your plans. However, it is the business *getting* side of the question that we wish to rehearse for you, so please permit our recital of an experience earned, but hardly deserved, and do not forget that our systematic minds planned, even as yours will, a straight, broad course to the object of our desires, and that we successfully arrived is hardly because of our scheme of operation, but more because of persistent effort inspired by the confidence that we could accomplish anything that had been accomplished anywhere else and do it even a little bit better.

Peoria, with a population of near 70,000, is the second largest city in the State, and is a wide-awake and hustling community, but its merchants and property owners were slow to become interested and were much slower to adopt a universally beneficial public improvement such as the lighting system in question, the cost of which, probably for both installation and maintenance, would have to be provided by them. This condition will be found everywhere and is hard to overcome. It would be very fortunate if the merchants would take the initial step in the matter, thus, to some extent, quieting the thought sure to arise in the minds of many of them, that the whole proposition was a scheme of the electric company and would be a source of great revenue for it, but rather than wait any considerable period for the merchants to take the initiative it is well to begin some activity that will father the desire and bring the question to their attention; there are no doubt many ways of doing this and our way succeeded.

About two years ago we induced one of our prominent merchants to install three five-light posts in front of his building, and it was not long until a competing

merchant followed the lead and installed similar posts, and soon other merchants inquired as to the cost of similar equipment. The number of these inquiries convinced us that the iron which we had placed in the fire was at last hot enough to strike, so we attended a meeting of the Association of Retail Merchants with a complete layout and costs of an extensive system of ornamental lighting, suggesting to them the advantage their association had as a body organized to further their own interests, to get behind the proposition and improve the retail district in a way that would reflect great credit upon the association and at the same time bring more of the general public more often into the shopping district, a result that could be accomplished in no other way at such small cost to each merchant. We were never pessimistic, but the outburst of such enthusiasm as was shown at that meeting was hardly expected, and when we came into town the next morning we were almost surprised that the system was not already installed—we were dreaming a year or more into the future, and during that year we learned a lot that we had not before known of human nature and the specie property-owner-with-a-long-lease-tenant. The merchants on the street selected as the future bright way were not slow to become organized into committees to handle the work necessary to accomplish the matter, such as securing a resolution from the City Council providing maintenance, deciding upon the style, number, the location of posts and securing signatures to frontage contracts. Judging from the time it took to do all of these things, there is not an easy job mentioned in the above list and the various committeemen soon found themselves reporting nothing but progress and doing little else than reporting, and even the formality of rendering a report was soon neglected.

There was no need for haste on any part of the plans until the frontage had been signed up, and many of the frontage signatures were mighty hard to obtain. It was arranged that the work of securing frontage signatures should be handled by a committee of three men on each side of the street in each block, and in this way most of the signatures easy to obtain were secured, but the conditions were the same as you have or will find in your own or any other city—unsettled estates—long leases, with the tenant or the owner unwilling to improve the property beyond absolute necessity, owners living or traveling out of touch with the situation and not within reach of personal argument. All of these conditions delayed matters to such an extent that most of the committeemen lost interest and practically gave up the scheme as impossible, and indeed it seemed almost so to us, but a few enthusiasts—you will find them in every community—never gave up hope, though a year's effort seemed to have produced absolutely nothing.

During all of this time we, for the company, remained very much in the background, but personally kept in touch with the situation and gave encouragement wherever we could. This was the condition of things when one day we were informed that a new pavement and new curbing that had been delayed for some time was to be placed on the street and that work was to start within two weeks. It was discouraging news, for the conduit must be laid ahead of the new pavement or the entire lighting scheme would be

FIG. 2.—TYPE OF STANDARD USED.

blocked for years, and we realized that in less than two weeks we must accomplish more than had been done within the previous fifty weeks. At this juncture we got in the game openly and rounded up the few real live ones among the former committeemen, and with them made personal appeal to the anti-improvement property holders and merchants. The same energy, if so applied, would have sold all the land in the Sahara desert, but the net result was that we had over 90 per cent. of the total frontage signed, sealed and delivered in time for us to have the material and labor on hand and put in the conduit as the pavement was going in. But we were not yet assured that the system would be installed complete in every block, as the 10 per cent. not signed was made up of frontages here and there all down the street and these signatures were the hardest to obtain. We were at the point where we had to get them, and every now and then our efforts were rewarded, until by the time the posts arrived the only unsigned space was in one side of each of two blocks. We were determined not to set posts in any block not fully signed up and soon had the posts erected in all of the other sections; the direct result of this was that the attention and efforts of the signers in the anti-blocks was directed to the non-signers, and the necessary signatures were soon received and when current was first supplied it was turned into a system that was as complete as that system is to-day.

Without any previous announcement, or any formality whatsoever, the first illumination was provided on a Saturday night, and before nine o'clock that evening the entire populace seemed to know of it, for the street was crowded and the city seemed wider awake than ever before. Their comment was not only favorable but flattering, and the general opinion of the towns-people and frequent visitors is that no other one thing has added so much to the city's appearance. One thing we are sure of, and that is that the proposition has justified itself to the merchants who made it possible, as their street is really crowded every evening, whereas other business streets are com-

FIG. 3.—ANOTHER VIEW OF THE PEORIA "WHITE WAY."

paratively deserted. In self-defense the merchants on two other streets have, in a very short time and in a similar way, financed similar lighting propositions which will soon be installed, and merchants on other streets have all but completed their arrangements for the same sort of a system.

We now have installed, and being installed, a total of 239 ornamental lighting posts, which includes seventy-four one-light posts just complete, ready for current on a residence street; in addition to the above, propositions are now being considered for a total of 102 five-light posts.

If the merchants in your city are backward in taking up the ornamental lighting proposition, send them over here to talk with the Peoria merchants.

The Gas White Way in New Haven

Until within a few weeks ago New Haven had never been stirred to action by the desire so generally manifested in the West to possess a "White Way." Perhaps the citizens have been content with the luster shed upon their town by the famous institution of learning of which it is the seat and which has played so conspicuous a part in the rowing and football annals of the country, with a greater or less number of scholars turned out as a by-product. It would perhaps be delving too deeply into the causes of the present world-wide unrest to draw any parallel from the simultaneous appearance of a republic in China and a White Way in New Haven; we merely call attention to the fact, and leave the conclusion to deeper philosophers. Equally noteworthy is the fact that New Haven's first White Way is a gas White Way.

A section of this is shown in Fig. 1.

FIG. 1.—THE NEW GAS WHITE WAY, ORANGE STREET, NEW HAVEN, CONN.

FIG. 2.—EFFECT OF ILLUMINATION OF FRONT OF STORE WITH TWO FIVE-MANTLE HUMPHREY INVERTED ARC LAMPS.

FIG. 3.—A WINDOW LIGHTING INSTALLATION WITH REFLEX LAMPS AND HOLOPHANE REFLECTORS.

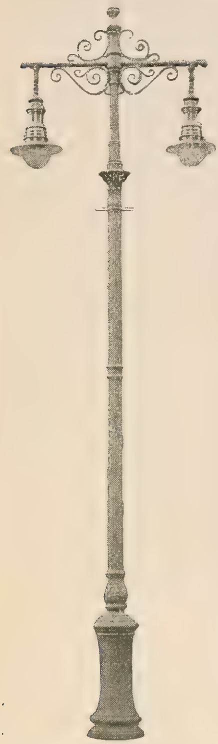


FIG. 4.—ONE OF THE ORNAMENTAL STANDARDS.

The installation consists of handsome ornamental posts, each supporting two Humphrey five-mantle inverted gas arcs. A daylight view of the post is shown in Fig. 4. The posts are staggered on each side of the street. That this White Way is "white" in the sense of being uniformly illuminated with a high degree of intensity is very clearly brought out in the photograph. The farther section of the street, shown in the background, is lighted with one of the modern forms of electric arcs. It is not at all difficult to note the place where the gas lighting leaves off. As a demonstration of what can be accomplished in street illumination, this is certainly an example worthy of careful and serious consideration. It will be noted that both the street pavement and the sidewalk show all details as clearly as to almost suggest that it is white, instead of the dark gray of stone and asphalt; and yet notwithstanding this high degree of intensity there is an entire absence of any troublesome glare.

The complete illumination of the store fronts, and even of unlighted windows, is another remarkable fact. This is more clearly shown in Fig. 3. As will be seen, the show windows are remarkably well illuminated; in fact, the merchandise shows better than in many cases, if not actually the majority, of stores having the windows specially lighted.

Fig. 4 shows what may be done with modern gas lamps for show window lighting, the windows in this case being lighted with inverted mantle lamps within and the gas arcs without.

In point of illuminating results it is evident from this demonstration that modern gas lighting, whether for interior or exterior use, has nothing to fear from any present competing illuminant.

It remains only for those interested in the production and sale of gas and gas lighting appliances to adequately present the merits of their product to the public to insure for this illuminant a fair measure of the decorative and other public lighting which is so rapidly expanding at the present time.

The White Way at Anniston, Alabama

By R. L. Rand.

The White Way at Anniston was lighted on August 19, 1911. The original installation consisted of forty standards. Since that time this number has been increased to fifty-seven.

The standards used are of cast iron and known as the "Southern Beauty" style, and are equal in appearance and in every other respect to any standard on the market.

The "Southern Beauty" standard weighs approximately six hundred pounds. It is equipped for five lights, one, in center, upright, and four, on arms, inverted. The standard is thirteen and one-half feet high.

On each standard is one globe, sixteen inches in diameter, for eight-inch holder and four globes, twelve inches in diameter, for six-inch holders. "Luceo" glassware is used.

Lamps used are 65 c.p. Mazda burning five in series on 115-volt circuit. To date the lamps have burned approximately five hundred and seventy-five hours without any burning out. In fact, no maintenance of any nature has been necessary, to any part of the system.

FIG. I.—DAY VIEW OF THE NEW "WHITE WAY," ANNISTON, ALA.

FIG. 2.—THE "WHITE WAY" AT ANNISTON, ALA., BY NIGHT.

Standards are placed twenty to a block, ten on each side of street with equal intervals of forty-five and one-half feet. Service wires are two number six rubber-covered wires laid under sidewalk, just inside curbing, in one-inch conduit. Conduit is placed in concrete and cement or tile sidewalk replaced. Feeder lines of two number four rubber-covered wires supply from the center of each side of a block. These wires are run in one-inch conduit in cellars of buildings.

The current is turned on and off by a clock switch situated on primary side of circuit. Signs and flat rate window lighting are on same circuit as the White Way. The hours for burning are from dusk until ten o'clock each night except Saturday and until twelve o'clock on Saturday night.

Contracts for three years covering the installation and lighting of this White Way were made by Anniston Electric & Gas Company's solicitors directly with the merchants. In some instances property owners assisted by assuming part of necessary amount. The rate was $1.65 per front foot per year payable monthly which, on a three-year basis, is calculated to refund the cost of installation and cover the maintenance and pay approximately seven cents per kilowatt hour for lighting.

While the securing of these contracts required persistent effort it was not such a difficult thing as might be supposed. It is advisable to assign this work alone to a solicitor, or a number of solicitors, as it has to be closely followed up and allows no time for other kinds of soliciting. If the endorsements of commercial clubs or merhants' associations can be secured they are of considerable assistance.

The White Way at Anniston has served to widely advertise the city and all concerned, the subscribers, citizens generally and the central station are very much pleased.

A Universal Photometer of Small Dimensions

By Clayton H. Sharp and Preston S. Millar

In the *Electrical World* of January 25, 1908, the writers described an instrument which had been designed for the requirements of the electrical testing laboratories, for a universal portable photometer. Since that time a larger model, embodying the essential features of the first model, but designed more particularly for laboratory work, has been constructed. In the use of these instruments by ourselves and others, it has been found that the larger model (39 in. or 100 cm. long) is eminently satisfactory for high grade laboratory work, and that the standard model (23 in. or 58 cm. long) is suitable also for much laboratory work in which a bar photometer had previously been employed. The larger model may be used for portable work if desired, although being designed more particularly for laboratory work, it is rather cumbersome and has a degree of accuracy which is higher than is necessary in most portable work. The standard model has been employed in portable work with much satisfaction, although its accuracy too is somewhat higher than is necessary for most field measurements. There is, however, a class of field work in which the accuracy requirements are less rigorous than those which the standard model is designed to meet and in which portability and convenience of operation are important desiderata. To facilitate such work a new model of the instrument has been built, in which the dimensions have been very materially reduced without any sacrifice in the usefulness of the instrument for this important class of work. Primarily this model was designed for the purposes of one of us on a journey through Europe during the past summer, where it was desired to obtain some photometric data of reasonable accuracy, but without the effort and difficulty which are required in the operation of the ordinary portable photometric equipment. At the same time the requirements for a

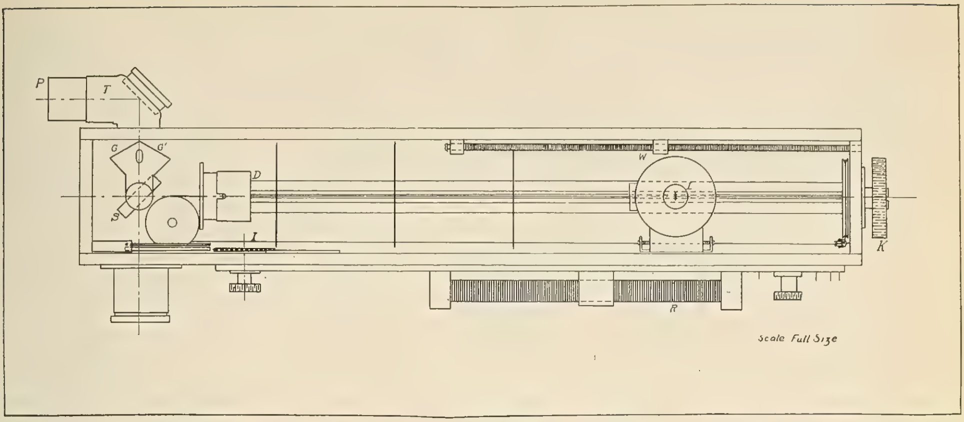


FIG. I.—PLAN OF SMALL MODEL, SHOWING ESSENTIAL FEATURES: *P*, REVERSIBLE TUBE, BEARING TEST PLATE AND DIAPHRAGM; *T*, ELBOW TUBE; *G* AND *G*, ABSORBING SCREENS; *S*, PHOTOMETRIC DEVICE; *D*, DIFFUSING GLASS; *I*, INTERRUPTER FOR TELEPHONE CIRCUIT; *L*, COMPARISON LAMP CARRIAGE; *R*, ADJUSTABLE RHEOSTAT; *W*, SCREW-DRIVEN CURSOR ON SLIDE WIRE IN BRIDGE; *K*, KNOB FOR COMPARISON LAMP DRIVE.

field instrument in general illumination work as ascertained in the use of the standard model were consulted.

It must be recognized that in a portable instrument observational errors of 2, 3 or 4 per cent. may be permissible, while systematic errors averaging 2, 3 or 4 per cent. above or below the true value may not be tolerated. In the first case by taking a number of readings, the true value can be reached; in the second case essentially false results are obtained. Therefore, in any instrument, no matter how great its portability, there must be involved no errors in principle, either of construction or use.

With this accuracy requirement fixed, the smaller model of photometer incorporates the essential features of the larger model through which accidental errors are minimized and systematic errors excluded.

Description of Small Model.

The length has been reduced to 14½ in. (37 cm.) and the cross section to 2½ x 2½ (6.3 x 6.3 cm.) the linear dimensions having therefore been reduced about one-half, so that the volume is only about one-eighth that of the first model. It can be very conveniently carried in a traveling bag or even in a capacious overcoat pocket. The scale has been reduced to one-half its former length. In the open part of the scale the accuracy of reading is still greater than the accuracy of setting, so that no loss in accuracy as compared with the other instrument has resulted. In the closed part of the scale the accuracy of reading is not so great as the accuracy of setting, so that here a sacrifice has had to be made. The mechanical construction of the instrument has been considerably simplified in its details. The elbow tube carrying the illumination test plate is placed on the back of the box in line with the eye tube.

The troublesome feature in all small portable photometers has been the comparison lamp. If an electric lamp is used a battery is required and some instrument

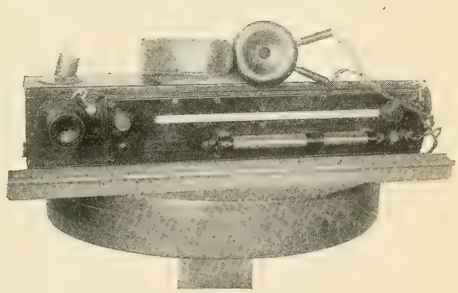


FIG. 2.—SMALL MODEL OF PHOTOMETER, SHOWING TELEPHONE RECEIVER EMPLOYED IN REGULATION OF COMPARISON LAMP.

for measuring the current passing through the lamp, or for adjusting it to standard value. The alternative for the use of an electric lamp is the use of a small oil or benzine flame. This makes the photometer independent in a way, but involves other troubles which are so serious that in nearly all cases the use of the electric lamp is preferred.

In some cases the use of a measuring instrument has been avoided by calibrating the photometer with a lamp connected directly to its battery and then relying on the constancy of the battery voltage until such time as recalibration can be made. This method of procedure appears to the writers to be inadvisable, being both less exact and more troublesome than the method where the constancy of the candle-power of a seasoned lamp is depended upon when operated at the measured current. To get results which can be depended upon without the use of an instrument means that a photometric calibration against some standard must be made at very frequent intervals. Also, as is well known, the voltage of a storage battery will run down slowly, even when it is not used at all. This fact makes the use of the photometer dependent upon the availability of a laboratory equipped with suitable measuring instruments and reference standards, where frequent calibrations can be made.

On the other hand, the constancy of a well seasoned lamp can be depended upon for a considerable period of time, a period which becomes indefinite when the lamp is not in use. It has been customary in the use of the larger model of photometer to employ a precision ammeter for the purpose of adjusting the current. In the smaller model it seemed desirable to find an arrangement which would be lighter and less expensive than a good ammeter; whence the following device, in which the large resistance-temperature coefficient of the tungsten filament is taken advantage of. The lamp is connected so as to constitute one arm of a Wheatstone bridge. The other arms are composed of small coils of manganin wire. Between one lamp terminal and one coil a portion of this wire is extended to form a slide wire, and a scale is arranged to indicate the position of the cursor on this wire. The

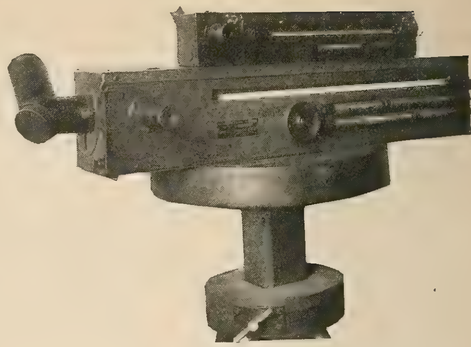


FIG. 3.—SHOWING RELATIVE DIMENSIONS OF ORIGINAL MODEL AND NEW SMALLER MODEL.

coils have such a resistance that when the lamp is receiving its proper current, its resistance will be such that the balance point of the bridge will come within the range of the cursor on the slide wire. Any change in the current flowing through the lamp is accompanied by a corresponding change in its resistance and the bridge is thrown out of balance. As a convenient means of detecting the point of balance of the bridge, a low resistance telephone receiver is used. In series with the receiver is an interrupter consisting of a wheel into the periphery of which pieces of insulating material have been set at frequent intervals. The two bridge arms which are in parallel with the lamps and its corresponding arm have approximately five times the resistance of the latter, so that the amount of additional current which they require produces no undue drain on the battery. The telephone receiver is provided with a head band so that both hands are left free for the operation of rotating the contact wheel and adjusting the external rheostat until a condition of silence in the telephone is attained. The adjustment of current in this way can be made to within about 1 milliampere (one-third of 1 per cent.), which is substantially the limit of accuracy of a high grade ammeter. Therefore the measurement involves in the shape of apparatus external to the photometer, only the telephone receiver, which can be readily carried in the pocket if desired.

The optical system has been somewhat changed. In place of the modified Lummer-Brodhun prism as a photometer

screen, a circular mirror of thin glass, silvered on the back, with a small round hole cut in the silvering, is employed. This mirror is placed at an angle of 45 degrees to the axis of the box and is viewed through the eyepiece in the ordinary way. The field which is seen looks like the ordinary Lummer-Bordhun field. The elbow tube carrying the illumination test-plate is placed on the back of the box in line with the eye-tube. The comparison lamp is a miniature tungsten filament lamp carefully seasoned. The carriage containing this lamp is driven by a cord and pulley arrangement by turning a knob at the end of the box.

Automatic baffle screens, similar to those employed in the larger models, are utilized, although they are mounted in a simpler and more rigid manner which permits the instrument to be used in any position without disturbing the operation of the screens.

The direct reading translucent scale, illuminated from within by the comparison lamp and calibrated in accordance with the inverse square law, has been found so eminently satisfactory in the larger model that it has been employed in this model as well.

For operating the comparison lamp a single small cell of storage battery gives the most constant results, but where preferable, two dry cells which the operator carries suspended on a strap over his shoulder may be used. As stated above, the instrument was recently carried by one of us on a trip through Europe, and illumination measurements were made with no difficulty on some of the busiest European streets.

Calibration and Use.

The calibration and use of the instrument are carried out as follows:

To calibrate with the illumination test-plate on the end of the elbow tube, the instrument is set up at such a distance from a standard lamp that the illumination on the test-plate is of a known value; for example, one foot-candle. The carriage is set with its index at 1 on the scale. The current through the comparison lamp is then carefully adjusted until a photometric balance is obtained. When this has been done the cursor on the slide wire is moved until the position is found where the bridge comes into balance. Thereafter the cursor does not need to be moved until it is found necessary to make a recalibration.

In the measurement of candle-power the following device is used: The test-plate on the end of the elbow tube is itself attached to a short tube which slips into the elbow. At the inner end of this short tube is a diaphragm. The tube may be pulled out and reversed, bringing the diaphragm to the outer end and the test-plate to the inner end, thus providing for measurement of candle-power. The tube and diaphragm then serve to exclude stray light from the test-plate, and if a lamp is set up at a distance of one foot from this test-plate its candle-power is read directly

FIG. 4.—ILLUSTRATING USE OF PHOTOMETER WITH DETACHED TEST PLATE.

from the scale, no recalibration of the instrument being required.

In a great majority of cases it is found more convenient to use a detached test-plate with this instrument. The detached test-plate, which is a plate with a white diffusing surface, is placed where the illumination is to be measured, the elbow tube is removed entirely from the photometer, the photometer is held in the hand and pointed at the detached test-plate, and the settings are made in the ordinary manner. It is evidently a simpler matter to put the detached test-plate in position than it is to arrange a photometer on a tripod, to level it and to get its attached test-plate in the required position. Hence this method of operating, though likely to be in some cases less accurate, is in general much quicker and more convenient than the other. Moreover, it frequently happens that illumination measurements are required in positions where it is very inconvenient to get the photometer itself. For instance, the illumination on the backs of a row of books on a shelf may be required. This is readily obtained by fastening the detached test-plate at that point and observing it from any required distance. Also the illumination of the ceiling of a room may be desired. The detached test-plate can be fastened to the ceiling or can be elevated by means of a pole and can be observed from the floor. All of these conditions have had to be met with the larger models of this photometer in practical work; with the smaller model they can be more conveniently met on account of the fact that the small model can be held in the hand while observations are being made, and that it requires no leveling or special adjustment. Evidently the calibration of the instrument will be different for the detached test-plate from what it is with the attached test-plate. That is to say, either the current through the lamp must be adjusted to another value or the readings must be multiplied by a suitable constant.

Virtually the same procedure serves for the measurement of the specific brightness of any surface. This is a measurement which we have often had to carry out with the other instrument. It is carried out in the same way with the smaller model.

Like the original model, the smaller model is fitted with two absorbing screens for extending its range, so that its total range may be from approximately 0.004 foot-candle to 2000 foot-candles.

In conclusion, it should be noted that the instrument here described will do nothing which the larger instrument will not do, but that it will do everything that the larger instrument will do, though in many cases with a slightly lower degree of precision. Where a photometer is desired for field work primarily, this model possesses the same superiority which a folding pocket camera possesses over a view camera for tourist purposes. It may be used much more conveniently and is likely to be used where the larger model would not be used, for the reason that the small model may be carried as a part of one's baggage, while the larger model has to be made a separate package, requiring special attention as such.

The Lighting Problem in the Automobile Industry

By W. A. D. Evans.

Probably no other line of manufacture has ever grown to such proportions in so short a time as the making of automobiles. As an established industry, it is scarcely a decade old, and yet it ranks to-day as one of the great industries of the country. The fact that the whole business is a creation of the past few years puts it in an exceptionally advantageous position in the way of physical conditions. The many large factories are all new, and therefore have the advantage of the most modern ideas in factory construction, arrangement and equipment. The enormous expansion of the business, and the fact that it has passed through one period of financial panic, proves that it must be as a general proposition on a profitable basis, and hence is in a position to utilize every improvement which promises to yield profits in the shape of decreased manufacturing cost. We should, therefore, naturally look to this industry for the best examples of machine shop lighting.

Beside the conditions already mentioned conducive to this result, there is the important additional consideration of the vital necessity of turning out the most nearly perfect workmanship that human science and skill can produce. Probably no other piece of machinery in use at the present time is subject to such great and unusual strains as an automobile; and certainly there is no piece of machinery in use, an imperfection in which may produce such disastrous results. That so few

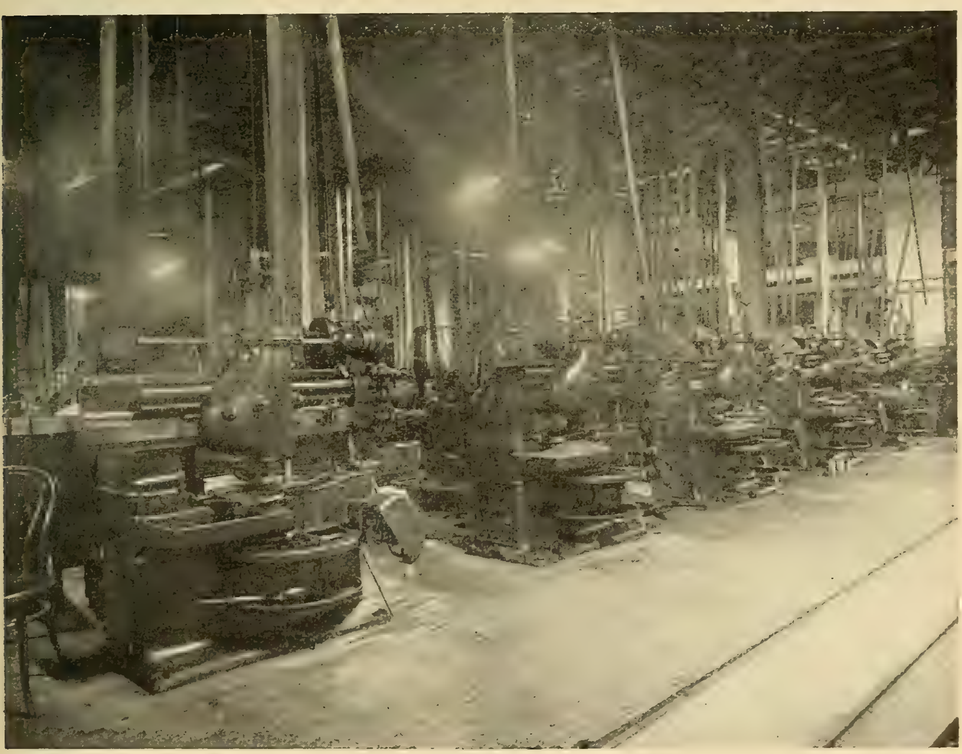


FIG. I.—COOPER HEWITT ILLUMINATION, GEAR CUTTING DEPARTMENT, LOZIER MOTOR CAR COMPANY, DETROIT.

FIG. 2.—THE TOOL ROOM BY COOPER HEWITT ILLUMINATION.

FIG. 3.—THE MILLING DEPARTMENT.

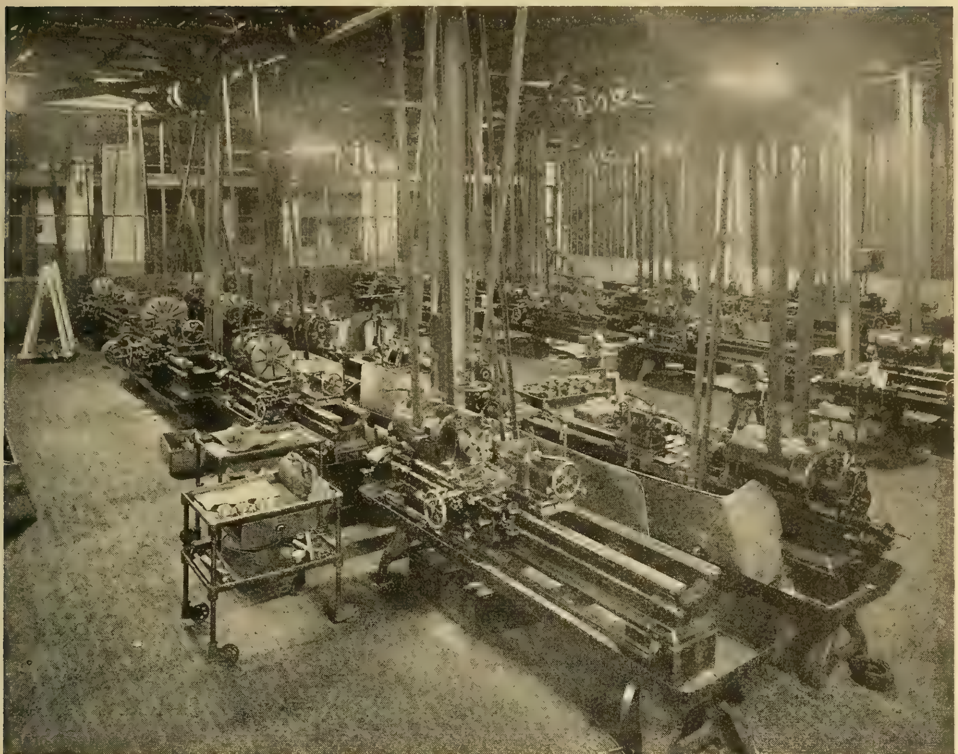


FIG. 4.—THE LATHE DEPARTMENT.

accidents in the use of the automobile result from imperfections in mechanism or material is a glowing tribute to the perfection reached by modern mechanical science.

The effect of competition has already been clearly demonstrated in the continual reduction in price of the product. The manufacturer is therefore studying every possible method of reducing cost. All of these conditions contribute to the necessity of using the best possible methods of artificial lighting. To reduce the efficiency of the workman and curtail the product by poor or insufficient light would be an unpardonable oversight or mistake. It is absolutely imperative that every workman be able to perform his work with the same speed, accuracy and reliability by artificial light as by daylight. This necessitates the use of such methods of illumination as will give practically the same conditions of illumination as those obtaining under the best daylight.

There is, perhaps, no other class of industrial lighting in which the glare produced by dazzling light-sources causes so much inconvenience as in the working of metals by machine tools. The freshly cut surface of the metal, which is the point which must be closely watched, is necessarily a good reflector, particularly as it is frequently covered with oil. Many of these surfaces are like mirrors, and will catch and reflect the image of a light-source perfectly, thus greatly aggravating the effect of glare.

Machine shop lighting has passed through several stages, beginning with the gas flame, with its acknowledged objections of unsteadiness, heat and danger from fire, then direct lighting with electric arcs, which generally necessitated additional local lighting, to special lamps and reflectors for each operative, a method which still persists to a greater or less extent. The best modern practice, however, as acknowledged by both illuminating and

mechanical engineers, is a sufficient degree of general illumination to afford the necessary intensity on the working points, with light-sources of sufficiently low intrinsic brilliancy to avoid dazzling glare. The Cooper Hewitt lamp fulfills these conditions to a high degree, and has therefore received much favor as a lighting unit in the automobile industry. The very material gain in visual acuity produced by the light by reason of its approximate monochromatic quality or to use common terms, from its green color, is especially advantageous in this class of work. It enables the workman not only to distinguish clearly the finest divisions on scales, scriber and punch marks, as well as blue print dimensions, but shows the character or quality of the work being done by the cutting tool with greatly increased clearness. This increase in visual acuity has the further advantage of enabling the eye to work with a relatively lower intensity of illumination, and therefore with less fatigue and less glare from the light-source.

The daylight quality of the illumination, in point of general diffusion and absence of sharp shadows, is well shown in the several photographs herewith reproduced, which were taken in the shops of the Lozier Motor Car Company in Detroit.

Fig. 1 is a section of the gear cutting department, showing the special automatic machines used for this purpose.

This room has a 12-ft. ceiling, and is lighted with twenty-eight lamps, or one lamp to each 800 sq. ft. of floor surface, thus representing a consumption of .5 watt per square foot, with a resulting illumination of four to five foot candles.

Fig. 2 is a section of the tool room, which has a 14-ft. ceiling, and is lighted in the same manner, and giving the same results.

Fig. 3 is a view in the milling machine department, in which all the conditions are the same as in the preceding case.

Fig. 4 shows the lathe department, also lighted in the same manner.

It should be particularly noted that in all these cases the general illumination answers for every purpose, no local lamps or special lighting whatever being used. The photographs are sufficient evidence of both the quality and intensity of light furnished, the photometric measurements adding additional evidence on the latter point.

The Relation of Public Lighting to Real Estate Values

"Trade Follows Light"

Much has been said in a general way in regard to good public lighting, particularly of the decorative character now becoming popular, as a general public asset. While many plausible arguments have been advanced there have been no definite figures given. The final test of a city's growth and progress is real estate values. In order to ascertain reliable opinions and, if possible, definite figures as to the effect of decorative street lighting on real estate values, we requested a number of leading real estate dealers and others interested in the public welfare in cities having modern street lighting installations to give opinions, and, if possible, figures as to the results upon realty values. Following are extracts from a number of the letters received in reply. These furnish perhaps the most conclusive arguments from the business standpoint of any that have yet been presented as to the positive value of good public lighting.

From R. W. Goode & Co., Real Estate Brokers, Buffalo, N. Y.:

From the point of view of a real estate man there is no question but that adequate street lighting adds to the value of real property. Especially is this true with reference to business property. It is difficult, perhaps, to give actual figures which will measure the increased value in dollars and cents, but property on a well-lighted thoroughfare always brings a larger rental income than on poorly lighted streets, and as a consequence such property is worth more money.

Local conditions have made Main street property much more valuable than adjacent streets, but we believe that if the other streets were as well lighted as Main street it would be a large factor in increasing the use of these streets, and consequently increasing the value of property for business purposes. There are many elements which go to make up the value of a particular piece of property, and we believe that proper street lighting is a large element to be considered.

From Edwin P. Ausley, Real Estate, Atlanta, Ga.:

In regard to the benefit derived from the new system of lighting on the downtown streets of Atlanta, known as "The Great White Way," I beg to state that, since its installation on Forsyth street, on which I have property interests, it has not only resulted in lighting and beautifying the thoroughfare, but has been one of the contributing means of largely increasing the traffic on this street, and consequently the value of all property along the line of "The Great White Way." I have long felt that light is essential to the life and growth of any business street.

From Harry G. D. Nutting, Manager of the Water and Light Commission, Fort Atkinson, Wis.:

We know that in a general way the popularity which our town has received since the installation of this system must necessarily have a good effect on real estate values. It is certain that, especially in a town of this size a system of this nature makes the city look like an entirely different place than it did before. The effect on the people is remarkable, in that it turns what we usually call a "knocker" into an enthusiastic "pusher" for the city.

From Eugene Creed, Sales Manager, Morris Iron Company, Frederick, Md.:

After the ornamental lamp standards were installed on King, Young, Queen and Front streets in Toronto, Can., the rents went up from 25 to 50 per cent., and the real estate men advised prospective tenants that with the new system of lighting a far greater number of persons would undoubtedly make use of the different streets, especially at night.

From W. B. George, Real Estate, Billings, Ont.:

I believe the use of electric lamp-posts will materially enhance the value of abutting property in any city. It will also assist in developing a pride and love in the citizenship for their city. A well-lighted city furnishes an attractive argument to prospective investors. I am well pleased that our city has installed lamp-posts throughout the paved districts.

From E. B. Camp, Real Estate, Billings, Mont.:

I wish to state that Billings has the reputation of being one of the best lighted cities in the West. In the past year I have been instrumental in bringing about $200,000 in capital from Oklahoma and other points to this city, and the thing that attracted most was our lighting system.

As president of the Chamber of Commerce I am in a position to know that our lighting system is being commented upon in the highest terms by the many strangers coming into our city.

From P. B. Sawyer, General Manager of the Des Moines Electric Company, Des Moines, Iowa:

One of the prominent real estate men here, Mack Olsen, states that he feels that the increase in rental rates of business property fronting this street lighting system have generally increased in amount that would be equivalent to a 25 per cent. increase in property values.

The case of a sale of a piece of property in this section of the city is that of a property purchased five years ago for $20,000 and sold two years after the electroliers were installed for $40,000. This, of course, does not indicate that the increased value is due wholly to the electrolier system, because there are other causes in Des Moines for the increase in property values.

Mr. Walker of Baird & Warner, 4455 Evanston Avenue, Chicago:

Their ability to concentrate business in the locality they are installed and thereby creating a demand, the result of which is no vacant stores, a better grade of tenant and more rental for same.

Mr. Lavery of Lavery & Taylor, 1122 Bryn Mawr Avenue, Chicago:

A noticeable increase of traffic; no vacant stores where posts are installed. Has also recommended property owners to install them in front of their stores in order that renting of them may be easier and of securing more money.

W. W. Paisley, Real Estate Manager for the Edgewater Bank, 5545-7 Evanston Avenue, Chicago:

A fine thing for everyone, and is, without question, of immense help to real estate.

Mr. Strassheim of Strassheim & Co., 2805 North Clark Street, Chicago:

The best of all classes of street illumination. To his personal knowledge they have been the means of renting a number of stores which had been vacant previous to the installation of the posts in his vicinity.

Mr. Schubert of Schubert & Springer, 1137 Bryn Mawr Avenue, Chicago:

Without question, they are of immense value in renting and of securing a better class of tenants, also of creating a demand for stores where posts are installed.

J. C. Schultz of Schultz & Garside, Southwest corner of Sixty-third Street and Ashland Avenue, Chicago, says:

That too much cannot be said in their favor. His experience of people renting a store is that they investigate the location at night and attributes the boom in that particular neighborhood to the installation of posts. Cites a personal case in the selling of his property. Before the installation of electric posts, he held the price of his property at $120,000, with no offers. Since the installation of the posts he increased the price to $130,000, with numerous offers for same, and attributes the increase of $10,000 to the installation of the electric posts entirely.

Niel Lykke of Lykke & Morell, 9215 Commercial Avenue, Chicago:

The installation of electric posts in South Chicago has, without doubt, increased property value, and is of an inestimable benefit to everyone.

From George P. Knight, Confectionery, Sporting Goods, etc., Cheyenne, Wyo.:

Electricity is the greatest boon to the business man as an advertiser ever devised, with one possible exception. Since the introduction of the tungsten street lamps in our city, rents and property have increased from 30 to 40 per cent. Business in general has not increased as well, owing to the depression that now prevails, but I don't think, under the most trying and adverse business conditions, any of the business men would do without them.

From Hon. Francis E. Warren, Chairman of the Committee on Appropriations, United States Senate, Washington, D. C.:

I wish to commend you, and through you your company, for the progressiveness in street and general commercial lighting in this city.

I have noticed particularly how rapidly the number of street lights has increased, and I can truly say that, in my opinion, Cheyenne is now one of the handsomest and best lighted cities in this country.

I am satisfied that the large increase in real estate values in this city during the past few years is, in no small measure, due to the enterprise shown by the citizens in co-operating with your company in carrying out the comprehensive street lighting system of this city.

From Hon. Joseph M. Carey, Governor of the State of Wyoming, Cheyenne, Wyo.:

The growth of Cheyenne has been steady and somewhat phenomenal during the past five years. Some of the very best buildings yet constructed have been commenced and finished during that period. Probably more residences of the kind required by the middle class and working people were erected during that period than during the fifteen years preceding. The values of real estate have increased at least 200 per cent.

Cheyenne is modern and progressive. She now has a fine water system which has cost fully one million dollars; she has a sewer system that has grown to meet the growth of the city; she has good mercantile houses, so that one need not go abroad to find any article needed in every day life.

Cheyenne is beautifully lighted by the Cheyenne, Light, Fuel & Power Company. This company has kept up with the times, and the beautiful system inaugurated a year ago in lighting the business streets is a joy to everybody.

From T. A. Fee, Architect, Vancouver, B. C., Canada:

Replying to your inquiry as to whether the installation of ornamental street lighting has improved business conditions on Granville street, I have much pleasure in stating that the results have proved as anticipated and our expenditure of over $30,000 for the same was a splendid investment.

We have been able justly to materially increase our rents, and, although in a city growing so rapidly and prosperously as is Vancouver, it is difficult to estimate exactly the percentage of increased real estate values due directly to this ornamental street lighting, I believe it has resulted in a substantial increase.

From Thomas Heaney, Manager of the Atlas Theatre, Cheyenne, Wyo.:

As president of the Industrial Club of Cheyenne, and later chairman of the Civic Committee about the time you conceived the idea of placing the tungsten street lights in the business section of Cheyenne, I wish to congratulate you on the value to Cheyenne of the system since its inauguration.

Without question, every line of business has taken on new life, this owing, I believe, to the more cheerful aspect of the retail district, which is now well illuminated; the old town seems to have taken on a niftier air; theaters and other places of amusement that were struggling are doing well. Real estate values have advanced and sales are more frequent. To us old boys who have spent the morning of our manhood on the plains your efforts have served to make life more pleasant.

From William H. Winslow, Vice-President and General Manager of the Superior Water, Light & Power Company, Superior, Wis.:

I find that real estate on our principal street has advanced between 25 and $33^1/_3$ per cent. since the installation of the ornamental street lighting. General conditions produced most of this advance, but the real estate men with whom I have talked seem to think that at least 5 per cent. advance can be attributed to the improved lighting. This would amount to about eight times the cost of the installation.

From Thos. H. Wright, Real Estate, Fort Dodge, Iowa:

I believe that all the property on Central avenue has increased in value more than the

cost of putting in the lighting system. On the 60 ft. that I own on Central avenue, on which I only get a rent of $216 per year, I gladly paid $105 toward the expenses of putting in the street lighting, and I would not have had them skip by my property for double that amount.

From B. H. Gardner, Dayton Power & Light Company, Dayton, Ohio:

We have seen several of the leading real estate men of Dayton and all of them report that unquestionably the value of real estate has increased since the installation of our boulevard lighting. While, of course, it is almost impossible to give any exact figures, still it seems from the reports we have received that there has been a decided increase in value of property in those districts in which our boulevard lighting has been installed.

One real estate agent reports that one of our large department stores decided to erect a building on a certain corner in town, the decision being very largely influenced by the fact that the boulevard lighting was installed in this section of the city. Since this store has started values have been increased by 50 per cent., and while this cannot all be on account of the boulevard lighting, unquestionably a large part of it is.

From R. A. Rowan & Co., Real Estate Brokers, Los Angeles, Cal.:

At the present time Los Angeles is conceded to be one of the best electric lighted cities in the world, and to trace individual instances of increased real estate values following different installations of electric light from time to time would necessitate a real estate history of many of our principal thoroughfares. One of the most important features making toward higher prices has most assuredly been the public street lighting, together with private enterprise in decorative lighting.

As to what argument, if any, can be advanced against decorative and improved lighting systems in relation to higher real estate values, it is hard to conceive. All highway and street improvements make most of the actual value of real estate, and certainly one of the most essential features is a well lighted thoroughfare for attractiveness and protection, whether in wholesale or retail business or residential districts, it is surely an imperative real estate adjunct.

From Red River Power Company, Grand Forks, N. D.:

The thought just struck us that if our lighting system as it is to-day was supplanted over night with the old system the town—and real estate values—would necessarily go back at least 25 per cent. That is only one way of expressing ourselves, but there is something in it; for instance, a downtown corner in the illuminated district that is now worth $40,000 might then not be considered worth more than $30,000. Putting it otherwise: if we had not installed our improved public lighting system that property might not have reached even a valuation of $30,000 to date.

Caryl Davis Haskins

MR. CARYL D. HASKINS.

Caryl Davis Haskins died suddenly on the morning of November 18 in Salt Lake City, where he had been stricken with pneumonia while on a business trip. His wife and little son reached him before his death. The funeral took place at his home in Schenectady on November 22.

Mr. Haskins was born in Waltham, Mass., May 22, 1867, and was educated in England, giving particular attention to mathematics and physics, and specializing in surveying and fortification work. He began his active labors early in 1887 with a company of mechanical engineers having headquarters in London and Boston. A year later he went with S. Z. De Ferranti & Co., where he had charge of the manufacture of electric meters, and also assisted Mr. De Ferranti in designing the original Deptford electric light station. From this time forward he was connected in various capacities with the electrical industry, his connection with business concerns being interrupted only for a comparatively short time during the Spanish-American War, in which he proffered his services to the Government and organized a corps of electrical engineers, of which he was made commander, and which did excellent service in directing the laying of mines, the establishment of signal stations and other electrical work.

In 1906 he was appointed manager of the Lighting Department of the General Electric Company at Schenectady, which position he occupied at the time of his death.

Mr. Haskins was a man of great force of character, which showed itself both in his executive ability and in his unusually wide range of knowledge in his chosen field. His habits of thought were analytical and exact and these elements were characteristic of all his work. His versatility is well shown in the fact that he was a writer of authority upon a great variety of engineering subjects, from fortifications down to the technical data involved in scientific investigations, and was even a successful writer of short stories. As a speaker and lecturer he was equally successful. The terse and trenchant style of his writing was given additional force by his equally incisive and impressive manner of presenting his facts and opinions. He spoke with the conviction that can only arise from the conscious mastery of a subject and confidence in one's opinions and conclusions.

His ready wit and ingenuous cordiality endeared him to all with whom he came in contact.

He took a prominent part in the society of the city in which he lived, being a member of the Mohawk Golf Club, the Mohawk Club, the local branches of various engineering societies and the Antlers Golf Club of Amsterdam. He was also a member of the Engineers' Club of New York and of the Massachusetts Society of the Sons of the Revolution.

Fixtures and Accessories

Fixtures for Semi-Indirect Lighting

Indirect lighting, which has been a storm center of illuminating engineering since it first began to attract public notice a few years ago, can now be said to have won its fight for recognition. Those who honestly wanted "to be shown" and approached the subject with an open mind have been satisfied by actual demonstration, while those who held a brief for direct lighting have accepted the popular verdict.

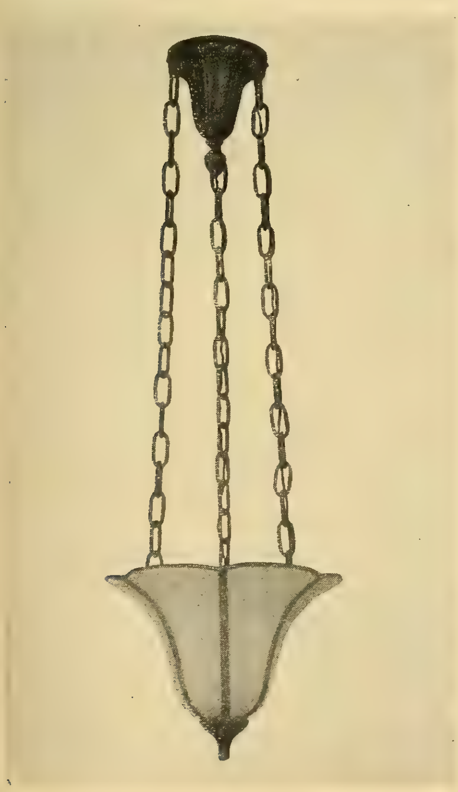


FIG. I.

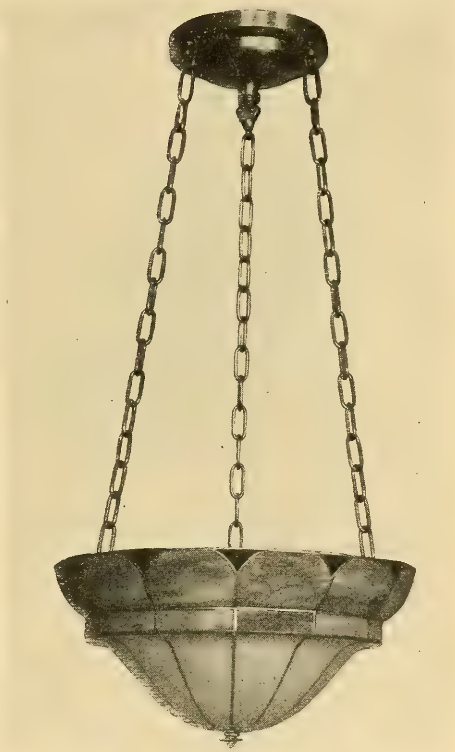


FIG. 2.

Indirect lighting, however, is not the *summum bonum* of all illumination, nor a panacea for all its ills; it is simply one system of illumination possessing certain peculiar advantages which make it the preferred method for a number of cases. By indirect lighting is now generally understood that system in which the entire ceiling becomes the visible light-source. This involves the use of opaque reflectors, which entirely hide the primary light-sources

FIG. 3.

while reflecting their rays to the ceiling.

The attention which indirect lighting has received has stimulated interest in what is generally termed semi-indirect illumination. This method is really the older of the two, and consists in the use of a translucent reflector of such type as to entirely conceal the form of the radiant while not entirely hiding the light-source. The chief advantage claimed—and with much reason—for this form over the straight indirect lighting is its more artistic appearance. It is held that the eye naturally seeks some point of origin for artificial light, and where this cannot be found there is an instinctive feeling of unnaturalness and incompleteness. Those having an artistic temperament deprecated the loss of the open fire when the iron stove supplanted the old-time fireplace. Hawthorne has voiced this opinion with his characteristic poetic phrase in a short dissertation on the subject. In a similar manner, it is argued, we feel the loss of an actual, visible source of light.

But our modern light-sources are too brilliant to be encountered directly by the eye. How, then, shall we harmonize these opposing conditions? The semi-indirect lighting unit is offered as a solution of this problem. While entirely removing the glare of the brilliant lights of to-day it furnishes a visible source of light which satisfies the esthetic instinct. Furthermore, such units have a much wider range of decorative treatment than the opaque, indirect lighting fixture. There is no method of displaying color so appealingly as by transmitted light. There are many effects in nature which it is impossible for the painter to reproduce on canvas, for the simple reason that they depend upon translucency rather than upon reflection. This whole field of translucent color is open to the designer of semi-indirect lighting fixtures.

A very simple fixture of this type is

FIG. 4.

shown in Fig. 1. This consists of a tulip-shaped bowl made of segments of translucent art glass set together in a metal flame and suspended by chains from the ceiling canopy. A single tungsten lamp fixed in a socket at the bottom of the fixture supplies the light. If an art glass of sufficient density and of light tint is chosen it furnishes a fairly good reflector in itself, thereby serving to produce indirect illumination from the ceiling.

A somewhat more elaborate variation of the same idea is shown in Fig. 2. In this case colored cathedral glass is used in the upper portion of the bowl which takes the place of the metal band often used in direct lighting fixtures of this type. A prismatic reflector is preferably used within the art glass covering, which greatly increases the reflection of light to the ceiling while still transmitting a sufficient amount to illuminate the bowl.

Fig. 3 shows a still more elaborate working out of the same idea in which there is opportunity for a great variety of color effects.

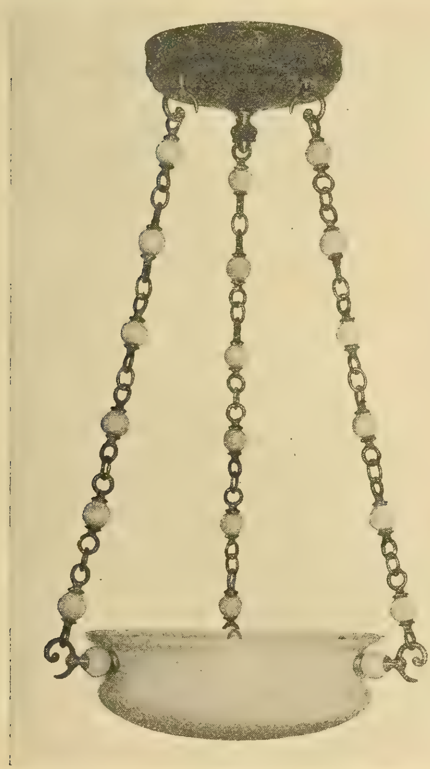


FIG. 5.

FIG. 6.

Fig. 4 and Fig. 5 show other treatments especially suited to rooms with comparatively low ceilings.

Fig. 5 illustrates a quite different method of construction, in which the bowl is of one-piece alabaster, or some of the new types of translucent glass which closely resemble the natural product.

Fig. 6 is another treatment of the same type, with the addition of three direct lighting units.

The semi-indirect fixture is undoubtedly destined to come into large use for residence lighting. The excellent hygienic results of the illumination produced, as well as great range of artistic effects of which it is capable, combine to give this type of fixture a very wide field of usefulness.

The Relation of Decorative Street Lighting to Show Window Illumination

Does brilliant street illumination interfere with or make unnecessary the interior illumination of merchants' show windows? This is a question which is giving lighting companies some concern at the present time. It is claimed that merchants in some cases neglect or abandon their own illumination of their windows on the ground that it is unnecessary, since they are illuminated from the street lamps, and in other cases because the streets are so brilliantly illuminated as to make their windows relatively inconspicuous.

The first of these arguments is scarcely worthy of a modern merchant. It is something like arguing that there is no necessity for maintaining good sidewalks in front of his premises because his customers can get to his store over his neighbor's sidewalks. There is a certain selfish pettiness about the argument that does not square with modern ideas of business independence. It is too much like reading the morning paper over your neighbor's shoulder, instead of investing a penny in a copy for yourself.

Aside from this sentimental reason, however, there is the much stronger one from the business standpoint in the fact that his show window depends for its lighting entirely upon the regular street lamps is dead. It is only laid out for public view, like a body in the morgue, instead of being a living personality like the show window lighted from within by its own proper installation. No amount of lighting from without will ever make a building, or any part of it, appear cheerful and inviting within.

"There's a light in the window for thee" is the expression of a sentiment that has appealed to humanity for generations past, and lives because of the inherent truth which it expresses, viz., the cheerfulness of the light within. A monument or mausoleum may be lighted from without; the abode of the living must be lighted from within.

Added to this is the still more definite technical reason that it is impossible to properly light a show window except from the inside, and then the full results can be obtained only with a careful study of the conditions and the application of sound engineering principles. The merchant who realizes the enormous value of his show windows will never for a moment consider losing any part of this asset by using them as mere dead storage during the evening when they might be inspected by thousands of possible customers. Unless they are to be lighted up with their own illumination the shutters might as well be pulled down.

The argument that decorative street lighting interferes with show window display by its greater brilliancy has really a more serious claim to attention than the former argument. Where the effort is made, as has unfortunately sometimes been the case, to see how big a blaze of light could be produced on the street, this result must inevitably follow to a greater or less extent. But this seeking after mere garish brilliancy, let us hope, has had its day; we are now getting down to the saner basis of considering the true decorative quality of light, which never includes

excessive brilliancy. The properly lighted show window will never suffer from real decorative street lighting. Much store-window illumination, however, still fails to come under this specification, but is merely a space lighted up with a collection of lamps without regard for the specific purpose of the illumination. If the faults of this sort of lighting are shown up by the more decorative street lighting, so much the better.

Finally, the merchant must not forget that he lights up his windows, not for the sake of the light itself, but for the people that will see his goods, and the value of his lighting is measured exactly by the number of people who pass his store. The great service then which decorative street lighting renders him is in creating traffic on his street, and so furnishing spectators for his show. It is well therefore that the merchant think at least twice on this subject before giving up his show-window lighting on account of decorative street lighting systems.

Must a Thing Be Ugly to Be Useful?

Judged by the appearance of very many articles of everyday use, this question is evidently answered in the affirmative to a very considerable extent by those responsible for their production. The ultimate reason for this opinion is hard to discover. Just why it should be thought necessary to offend any of the feelings or senses by thrusting the constant or even casual forms of ugliness before us is one of the unexplained anomalies of human nature. It can scarcely be laid to tradition or evolution, for the very earliest forms of handicraft, such as pottery and weapons, exhibit attempts at decorative treatment; and it is a well known fact that written language had its beginning in poetry. Herbert Spencer has even shown that dress had its origin in a desire to decorate the body rather than to protect it. The production of a useful article made ugly by a misunderstanding of the nature of art can readily be explained and forgiven, but the turning out of an article that is ugly through evident malice aforethought is an idiosyncrasy that baffles philosophy and logic.

This tacit acceptance of the uncouth and inartistic has many different phases. In the realm of literature it shows itself in the treatment of practical or scientific subjects in a manner incomprehensible except to the iniated few, and in a form so dry and shriveled as to render it a labor of loye for even them to wade through the matter. This careful elimination of all human touch in the literary execution is fittingly set forth in a dress so inherently ugly as to give fair warning of the character of the contents; in evidence whereof let the reader examine a copy of the average technical or trade publication. Anything more hopelessly inartistic than the combination of paper, type and general design can only be found in some varieties of dogs which have been bred for ugliness for generations past.

The makers of lighting devices have perhaps been as great sinners in this respect as any other class of artisans. It would be hard to beat the first commercial arc lamps in point of hideousness in appearance, and the flaming arc of recent production is scarcely better off in this respect. The so-called "gas arc" also unhappily comes in for criticism along this line. While it is not so aggressively ugly, it has never been treated in the artistic manner of which it is capable. In fact, it affords one of the most curious examples of the conscious imitation of a form that was ugly with more or less justification from the necessities of mechanical construction. The gas arc is a comparatively simple piece of mechanism, and there is no rhyme or reason in trying to see how near it can approach the electric arc lamp in plainness of design.

The *Saturday Evening Post* recently published two articles by Mr. James H. Collins, in which he discusses the "Business Advantages in Attractive Design," which contain some excellent advice on this subject, backed up by actual experiences. As one of the instances cited applies directly to the subject of light we quote it in full:

> For ten years a certain manufacturer in this country had been making a patent kerosene lamp. It was a perfect article, mechanically speaking. The burner was devised on an ingenious principle, the draft and illumination were calculated to a nicety, and the

lamp threw an abundance of mellow white light from a broad flame, burning little oil and giving off no smoke or odor. But the sales of this lamp fell far short of its merits. The maker pushed it in various ways, trying plan after plan. He advertised, explaining the principle upon which his lamp was constructed, and his advertisements brought plenty of inquiries from people who should have become profitable customers. There was the general development of suburban and summer homes to favor him. The sale of one lamp to the owner of a large country house, a seaside cottage or a mountain camp ought logically to have brought orders for more. But it was just this sort of business that did not grow. The chief sales seemed to be to farmers and people in small towns, who wanted one lamp to light the living room.

The manufacturer also sold his lamp through the trade. As a rule, after a capable salesman had been shown the principle upon which that lamp operated and had been given some figures in comparing it with other kerosene lamps in lighting power and economy of oil, he could go into any territory and place goods with the largest stores. Merchants and buyers too were easily won over by the mechanical beauty of the lamp, but the lamp itself did not stay in the stores. Merchants who stocked it, expecting great things from its ingenious principle, were soon glad to drop it because it did not sell. This manufacturer spent ten years and a good deal of energy and money to demonstrate the truth of something that George Meredith put in a single phrase:

"Ugly is only halfway to a thing."

His lamp was ugly. Its looks were killing demand with the best class of potential customers. When he selected metal receptacles this manufacturer had conscientiously provided good brass, heavily plated to live honest wear. But he knew nothing of the possibilities that lay in design and so his brass containers were squat and square with not one redeeming line. A certain attractiveness might have been secured by leaving the metal surfaces plain. But even this possibility had been destroyed by meaningless ornaments stamped everywhere—four-leaf clover and horseshoe motifs, flubdubs and borders of tinsmiths' delight. The glass shades were ornamented with nonsensical convolutions and their colors were nondescript, like London neckties dyed to be worn in a fog. The whole lamp was so perfect mechanically that people who read about it asked for it in the stores. It was so ugly in design that nobody with half an eye for harmony would have taken it as a gift, especially when it was shown beside European goods of handsome design—as it always was.

A skillful designer took this patent lamp in hand. Several new shapes were worked up in the period styles so popular just now. There was a Colonial model, an Empire model, a Louis-Quinze model, and so forth. When these new goods were put upon the market the effect was immediate. Department store buyers, who had thrown the old models out of stock, warmed up to that lamp again and put it back. Customers who were shown a Colonial or Empire shape bought without objections. Advertising began to sell goods in good country and suburban homes, repeat orders followed, and wherever a house was fitted with those lamps a center for new sales was created among neighbors who wanted the same goods as soon as they saw them. To-day, as the result of a little attention to looks, that lamp manufacturer is getting a volume of trade to which he was entitled all along on account of the utility and honesty of his product.

The title of Mr. Collins's articles is "The Next Big Item—Looks." Every maker of lamps and lighting accessories, as well as every illuminating engineer, ought to paste this title up over his desk or workbench, and never leave it entirely out of his mind. Illuminating engineering has rightly taken up the subject of mechanical efficiency first; it is now ready for "the next big item—looks."

The Government and the "Lamp Trust"

As previously noted in these columns, the suit instituted by Attorney-General Wickersham against the General Electric Company and the National Electric Lamp Company and its subsidiary companies for alleged violation of the Sherman Anti-Trust law has resulted in settlement of the case between the Attorney-General and the defendants. While a settlement out of court undoubtedly had its advantages from the business standpoint, chief among which is an immediate conclusion in place of long drawn out litigation, it is disappointing from the public standpoint in that it leaves undecided several highly important questions.

The settlement of the suit, which has been accepted by the court before which it was brought, involves three principal points:

First, the restraint of the manufacturers from making or carrying out any contracts involving a "resale price." The control of prices, therefore, ends with the customer to whom the goods are originally billed.

Second, the prohibition of agreements with manufacturers of material, or parts of lamps, by which the defendant companies receive preferential prices.

Third, any attempt to control the sale

of carbon lamps by making their purchase a condition to supplying the newer forms of lamps on which the defendants control patents, is forbidden.

Fourth, the owner in fact of the National Electric Lamp Company and its subsidiary companies, viz., the General Electric Company, must publicly acknowledge this ownership.

The acceptance of the decree involving these principles may be taken either as an admission on the part of the defendant companies that they were transgressing the Sherman law in the manner charged, or that they preferred to accept this version of the case rather than endure the expense and uncertainty of a long and costly litigation. The wise citizen of this country has learned to accept any compromise short of actual destruction rather than to submit to the law's delay and uncertainty. This fact in itself constitutes such an indictment of our administration of law and justice as to cause the thoughtful to wonder whether after all the anarchist has not good and sufficient grounds for his abhorrence of all law.

The patent situation in this country, on the other hand, is a crying outrage; it furnishes greater opportunities for persecution and legal robbery through the channel of litigation than all other sources put together. It is to be hoped that the popular agitation and legal action against real or apparent monopolies may arouse sufficient public attention to bring the patent subject into politics and thus force it upon the attention of Congress.

In some respects the decree in the present case is anomalous. The National Electric Lamp Company is a holding company, transacting no business except the purchase of the corporate stock of other companies and receiving the dividends thereon. It is simply one of numerous corporations of this type. The majority of the stock of this company in turn is owned by the General Electric Company. According to the decisions in the other notable cases, such as the Standard Oil and American Tobacco Company, it would seem that the logical course would have been to require the actual separation of the different companies whose stock was held by the National Electric Lamp Company and the abandonment of that company by the General Electric Company; in other words, placing the several manufacturers that were independent before their purchase by the National Electric Lamp Company back into their original independent ownership. For some curious reason exactly the opposite to this has been done; the General Electric Company has been required to absolutely absorb the formerly independent companies and to publicly acknowledge this absorption. Just how this course can be squared with the other decisions is beyond the comprehension of the layman; it is probably clear to the high legal lights involved, but is hidden in obscurity to ordinary mortals.

As to the effect upon the public, there seems to be little probability of change, at least for some time to come. Dealers may cut their prices slightly on lamps, but are not likely to reduce their legitimate profits to any great extent. Meanwhile the enormous expenditures for improvements in the quality of the product will undoubtedly continue, so that the American user is likely to have the satisfaction for some time to come of being able to purchase the best electric lamps in the world at a cost which will gradually diminish, at least in the case of the new lamps, as manufacturing costs are reduced. This has been the history of the industry since the electric lamp first came into practical use and there is no prospect of a change in this respect.

The manufacture of carbon lamps at prevailing prices offers no special inducement for the investment of capital. They must be made in large quantities in order to insure a reasonable manufacturing profit and their use will unquestionably gradually diminish. No considerable competition in this line is therefore imminent. The new lamps are all covered knee-deep with patents, and even if suits were immediately brought to determine the validity and scope of these patents, it would be years before a decision would be reached; in fact, the patents would probably have expired before that time, as is often the case in important patent litigation.

Mr. Samuel Untermeyer, probably the most astute corporation lawyer in this

country, characterized the final action in the Tobacco Trust case as a mere matter of the company changing clothes, and the Standard Oil decision has been characterized as a change in its method of bookkeeping. The decision in this case seems hardly to demand even this interruption, and except that it pertains to a general subject upon which there is much agitation and newspaper publicity, the public would probably never be aware of the institution of the suit or the decision reached.

Recent Developments in Portable Illuminometers

Illuminating engineering as a science is based upon the measurement of light. Until photometry had reached a state of perfection which fairly entitled it to be classed among the exact sciences, the treatment of illumination as an engineering problem was out of the question. Conversely, the institution of illuminating engineering as a separate branch of science has had a powerful influence in developing the science of photometry. The first demand of the illuminating engineer was for a portable photometer capable of measuring intensities of illumination. As such an instrument differs in some respects in construction, and radically in the quantity measured, from the regulation photometer, it has been given the general name of illuminometer, although designers of instruments of this class have attempted to attach some special trade name to their product, such as "lumenmeter," "luxometer," "lumeter," etc.

The immediate result of this demand on the part of illuminating engineers was the production of the Sharp-Millar portable photometer. In the design of this instrument the methods and devices that had proven most accurate and reliable in laboratory photometers were adapted to a portable instrument, and the necessary additions were made to render it serviceable in measuring illumination and surface brightness. The instrument deservedly became standard, and considering the newness of the profession of illuminating engineering, achieved wide use. It is not too much to say that the Sharp-Millar illuminator has been one of the most substantial helps in placing illuminating engineering upon a sound and permanent basis. The designers of this instrument are well-known photometricians, accustomed to seeking the highest degree of accuracy possible with all the appliances available in a well equipped laboratory, and they have consistently opposed the design or use of any instrument which afforded opportunities for any great variation from this laboratory accuracy. While their instrument was portable to a higher degree than any previous instrument of its class, it still lacked that degree of portability which would make it available for everyday use by the average illuminating engineer. Furthermore, the use of measurements in illumination, and the terms in which they are given, has become very much more familiar to the public than at the time this instrument was designed. This fact has increased the demand and field of usefulness for a smaller and more portable device.

Two instruments of an extremely compact and portable character have appeared in England during the past year, and apparently give good results, even in untrained hands. The practice recommended by their inventors, however, of trusting to the constancy of a storage battery without checking up with some sort of electrical measuring instrument, does not meet the approval of American illuminating engineering practice. Measurements are made for the sake of certainty, and anything that shakes our belief in this greatly reduces their value. With a suitable device for measuring the current supplied to the standard lamp the English illuminometers would undoubtedly be serviceable instruments.

In another section of this issue we publish the description of a new form of the Sharp-Millar illuminometer, which has been recently constructed by the original designers. As will be seen, this is practically a miniature edition of their original instrument, all the essential principles having been carried out in a smaller way. As the writers state, this instrument is capable of doing all that the original instrument would do, but with a slightly greater limit of error. The need of an instrument of this kind is particularly felt at the pres-

ent time, in view of the active interest being taken by State commissions and social organizations in the subject of legislative regulation of industrial lighting. A successful portable illuminometer is the key to the whole situation. When this appears the matter of illumination will be one of the easiest of all factory conditions to specify in factory laws. We believe we are safe in stating that an instrument meeting all practical requirements for this purpose has arrived, and that it will give a greater impetus to the recognition and application of illuminating engineering than any event that has transpired since the science and profession took definite shape.

End of the Heany Lamp Case

The fact that the only serious effort to obtain a patent by fraud has been in the line of improvements in electric lamps may be taken as peculiar evidence of the enormous field of profits which are open to the successful inventor in the field of illumination. More noteworthy still is the fact that, though a million patents have been granted in this country as the result of the work of comparatively poorly paid employees of the government, the integrity of the Patent Office has been maintained almost without spot or blemish. This fact is still more remarkable to those familiar with Patent Office practice, to whom the opportunities for frauds, such as were attempted in this case, are familiar.

Briefly put, the case was as follows: Heany was experimenting in various lines of research in the production of electric lamps, in the hope of discovering a better radiant for arc and incandescent lamps. In 1904 he applied for patent on incandescent lamp filaments. At a considerably later date various German inventors made applications for patents covering processes for producing a pure tungsten filament incandescent lamp. As Heany's patent had not yet been granted it would invalidate any later claims made by other inventors of the same character. It appears that Heany's original application did not contain any such conflicting claims, but that two employees of the Patent Office who had access to the records substituted a set of revised claims in the Heany patent so as to make it cover some of the claims of the German inventors, the revised specifications being taken from the later patent applications.

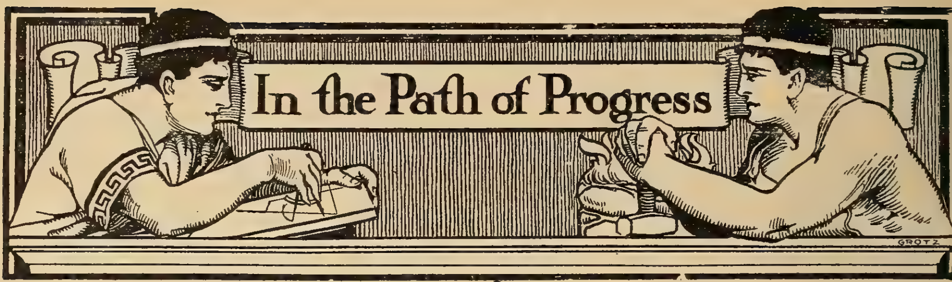
The discovery of this fraud resulted in a criminal suit, in which the two Patent Office employees were convicted and Heany was acquitted.

The question then came up as to Heany's right to a patent on his original claims. The court ruled that if it could be shown that Heany had knowledge of the changes made by the Patent Office employees he was not entitled to any patent whatever; otherwise his original claims might stand on their merit. After a careful investigation of the subject by the Assistant Commissioner of Patents, Heany's original claims have been rejected on the grounds of knowledge of and participation in the frauds committed by the Patent Office employees. This is a final disposition of the case, which leaves the claims of the several German inventors free of any interference from this source.

A Correction

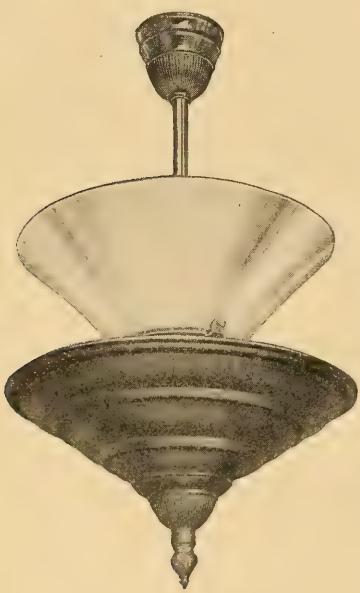
In the article in our last issue on "The Selection of Factors of Safety for the Designing of Lighting Systems," by Mr. R. F. Pierce, there were several clerical errors. On page 476, sixth line from the top in the right hand column, 80 per cent. should read 20 per cent. The last full paragraph on the same page should read as follows:

"The 100-watt drawn wire filament tungsten lamp, operated at top voltage, depreciates 20 per cent. in candle-power during the useful life of 1,400 hours, and it thus appears reasonable to rate this unit at 53.5 M. S. C. P. During this period, the average input appears, from published data, to be about 98 per cent. of the initial, hence the efficiency rating at .524 M. S. C. P. per watt."



A Novel Indirect Lighting Fixture

One of the most serious objections to direct lighting for commercial use is the loss in efficiency due to blackening of the ceiling. To overcome this objection Klemm & Co., Philadelphia, have designed a fixture in which the secondary reflecting surface is a truncated cone of opal glass. The construction is clearly shown in the annexed cut. The lower piece is of spun brass or metal, which encloses the light-source and primary reflectors. The second reflecting surface can thus be easily cleaned at the same time that the primary reflector is cleaned, or when lamps are renewed.



A NEW KLEMM CREATION FOR INDIRECT LIGHTING.

"Parian" Reflector Shades

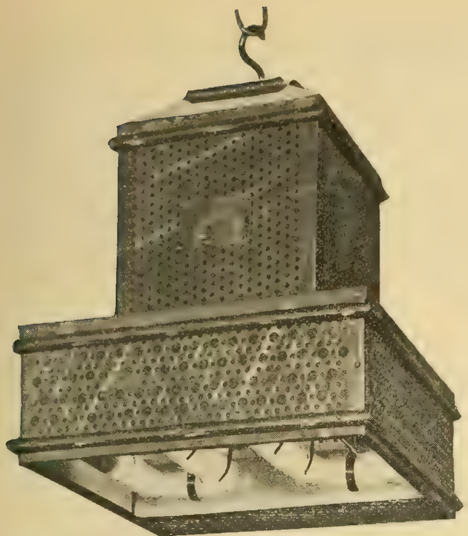
Under this name Gill Brothers Company, of Steubenville, Ohio, have introduced a line of reflector shades for Mazda or tungsten lamps made of a translucent reflecting glass of the new type. The shades follow the lines that have been found most effective, and the design is a simple arrangement of flutings, which, while decorative, offer no obstacles in the way of cleaning. "Parian" reflectors are notable not only as a new line in themselves, but as marking the entrance of these old and well known glass manufacturers into the general field of illuminating glassware. Their large and favorable acquaintance throughout the country, extending over a period of many years, should afford a ready acceptance of their efforts in their wider field.

A New Hanging Type of the Moore Light for Color Matching

Another step in the progress of the Moore Light is evidenced by the marketing of type E-22, factory-built unit hanging from the ceiling at any desired distance. This new unit is the smallest commercial type of the Moore light. A rectangular metal case 18 by 18 inches encloses the grid-formed 1¾-inch diameter Moore Light tube 6½ feet in total length.

This standard outfit operates on 220 volts, 60 cycles alternating current and consumes only 600 watts of electrical energy. The apparatus can be modified readily for special voltages and frequencies. When direct current only is available a small inexpensive rotary converter can be installed. The metal case is neatly constructed and oxidized.

This new unit can be utilized in many classes of business for specialized color



THE NEW MOORE LIGHT COLOR MATCHING UNIT.

matching purposes and bids fair to occupy a field as large as that now enjoyed by the Moore Light Window, type D-8, in the textile and allied industries.

New Publications

Scientific Illumination

Under this title the Macbeth-Evans Glass Company, Pittsburgh, have issued a very handsome booklet containing 48 pages. It is illustrated with half-tones and line cuts, and bound in boards. The sub-heading on the title page is "Good Light as an Asset—How to Get it at Right Cost."

"Why this book?" is the title of a short preface, which answers the question as follows:

"The demand for scientific and economical lighting is spreading rapidly, and a number of technical books on the subject have recently been published. But, unfortunately, little of this printed information is intelligible to the layman. There seems to be need of a brief, clear, accurate statement of the main facts, such as any business man may find suggestive and useful."

"Harmony in Home Lighting and Furnishing"

The above is the title of an exceedingly attractive booklet issued by R. Williamson & Company, Chicago. It contains 24 pages with an art paper cover with a handsomely embossed design, and is profusely illustrated with half-tone cuts. The object of the booklet is to give the user of lighting fixtures, particularly the householder, a general idea of the principles involved in securing harmony in house furnishing and decoration, the lighting fixtures being treated as an important element in the furnishing scheme. The last page contains a talk on the practical construction of fixtures, with special reference to the product of this house.

"Light and Art in the Home"

This is the title of a brochure issued by the Beardslee Chandelier Manufacturing Company, Chicago. It contains 16 pages and cover of art paper embellished with a particularly striking poster design. It is printed on India tint, matt surface paper in gravure brown, and contains a number of half-tone illustrations of typical fixtures manufactured by this company. In the foreword attention is called to the fact that this company places their trade-mark on all of their product. This is notable as the first consistent effort in the fixture trade for the manufacturer to trade-mark his product, and thus insure for himself the protection of his artistic ideas and the mechanical excellence of his workmanship.

The booklet, like the one previously mentioned, is also notable as being an effort to give the purchaser of fixtures some real information on the subject, instead of merely passing him out a picture book with no other information than a number by which to designate the fixtures illustrated.

"The Art of Public Lighting"

Under this title the Gleason-Tiebout Glass Co., Brooklyn, N. Y., have issued a booklet of 20 pages and decorative cover dealing with the new decorative public lighting.

A number of the most conspicuous installations of decorative public lighting throughout various parts of the country are illustrated, and the part which illuminating glassware plays in public lighting is treated in a popular way. The booklet is attractive in appearance, and

should be useful to central station solicitors, and municipal engineers, as well as others having to do with public lighting.

SUGGESTIONS FOR GOOD LIGHTING.

This is a small booklet of 16 pages and cover issued by the Handel Company, Meriden, Conn., and illustrates and describes a number of table lamps and lighting fixtures manufactured by this company. The designs shown are modern and attractive.

CHARACTER IN LIGHTING FIXTURES.

This is a title of a booklet issued by the Horn & Brannen Mfg. Company, Philadelphia, containing 72 pages and cover. It is practically an abridged catalogue, giving some of their more recent designs of fixtures especially suited for domestic use. There are brief comments on the designs, with suggestions as to the rooms for which they are best suited.

The Haskins Glass Co., Wheeling, W. Va., have issued a booklet of 16 pages with decorative cover illustrating their Haskins-Lucida globes, spheres and reflectors. The different types of reflectors are illustrated in half-tone, accompanied by distribution curves. Sketches of lighting fixtures are shown suggesting uses for the different forms. Sufficient data is given for illuminating engineers having occasion to handle this line of reflectors.

Gillinder & Sons, Inc., of Philadelphia, have issued a booklet of eight pages and decorative cover showing their line of Melilite reflectors. The different types are illustrated with wood cuts, and light distribution curves are given.

The National X-Ray Reflector Company, of Chicago, have issued a complete revised edition of their various circulars, reprints and photometric data, and supplied in a neat binder. This includes a number of actual photographs of typical installations of the Eye-Comfort System of indirect lighting, a catalogue of indirect lighting fixtures, a pamphlet with a title, "Conservation, Save the Eyes," which consists of reprints from articles in various technical journals describing and illustrating installations, also a catalogue of reflectors and a pamphlet on "Efficient Show Window Illumination."

Curves of distribution of reflectors are given and engineering data directions in regard to show window lighting. Altogether the collection is a very comprehensive exposition of the claims of this method of lighting and of engineering data for its proper installation.

Personal

Mr. H. L. Parker has resigned as Illuminating Engineer of the Consolidated Gas, Electric Light & Power Company of Baltimore. He was tendered a farewell dinner on November 16 by a number of the members of the Commercial Department of his company. Mr. Parker intends to take advantage of his cessation of duties with the company to take a short vacation, and will not engage in regular work until the beginning of the next year. In view of the fact that he anticipates being connected with manufacturing interests rather than direct central station work, he has also resigned as Chairman of the Commercial Section N. E. L. A. on Commercial and Industrial Lighting.

Mr. Marshall W. Gleason, senior member of the Gleason-Tiebout Glass Company, has been made Managing Director of the Opalux Company. The Opalux Company has our sincere congratulations upon receiving the active support and co-operation of one who has been so long connected with the glass industry, and with a company whose reputation for fair dealing and courteous treatment is excelled by none in this country.

Mr. Gleason's connection with the younger company should add materially to its strength and prestige.

The American "Z" Electric Lamp Company of New York has issued a license to Kilburn Brown & Company of London, under which the last named firm is allowed the exclusive selling and manufacturing rights of "Z" tungsten lamps in the United States. The business will be conducted after December 1, at their new offices at 29 Lafayette street, under the style, American "Z" Electric Lamp Company, Kilburn Brown & Co., sole licensees.

Proceedings of Technical Societies

The National Commercial Gas Association

Fifth Annual Convention.

The fifth annual convention of the National Commercial Gas Association, which was held in Denver during the week beginning October 23, was interesting from all points of view, and in several respects decidedly noteworthy. In point of numbers it furnished a record which is seldom equaled, the total registration being 550 members and 200 guests out of the total number of the association at the time of 2900. Not only is this number large in itself, but relatively great in proportion to the membership, especially considering the fact that Denver is a considerable distance from the larger proportion of the members.

The papers presented were the most representative and least perfunctory of any convention programme within our observation. The sessions were uncommonly well attended, the interest in the papers was genuine and the discussions spirited and eager. The entertainment features were head and shoulders above those ordinarily provided on such occasions. This was due, of course, to a considerable extent to the many unusual opportunities which Denver affords for sight-seeing and experiences which are novel to the Easterner. The elaborate programme was carried out with as complete success and freedom from mistakes and annoyances as if it were an everyday occurrence.

Most notable of all, and the feature which will be longest remembered by those in attendance, was the cordial and genuine hospitality shown to the attending members and guests by the citizens of Denver. There is, perhaps, a feeling among the Denver people that they have a reputation for hospitality which it is well to sustain; but while this is probably true, strangers who have had occasion to test its quality will never be persuaded after all that it does not spring from a real desire to have all strangers enjoy, to the fullest extent, the peculiar advantages and characteristics of the city and its wonderfully impressive and beautiful surroundings. To the pioneer in a new and strange country any guest is welcome, and the inhabitant of even the same State is a near neighbor. It is less than fifty years ago that Denver was only a mining camp, and its surroundings were all comprehended in the words, "Pike's Peak." The open-handed and open-hearted hospitality which the stranger in those parts still meets is perhaps a legacy from this pioneer virtue. Whatever its origin, there is no doubt as to its existence.

The exhibition of gas appliances held in connection with the convention was highly creditable to the manufacturers, and a source of information and interest to the visiting members.

The most noteworthy fact connected with the convention from the illuminating engineering standpoint was the comparatively large amount of attention given to the subject of gas lighting. Out of a programme of eleven papers four dealt with various phases of the subject of illumination, while two others had a collateral bearing on the subject. These papers elicited the most spirited discussion of any of the programme, the echoes of which were heard among the members in their personal discussions outside the convention hall. Incidentally, it is of interest

to observe that the opening and closing papers of the convention were on the subject of illumination. That there has been a very general awakening on the part of the gas interests in the subject of illumination and a realization of the importance of waging an aggressive campaign in order to maintain their position in the lighting field, there can be no doubt; and this convention both reflected the progress made in this direction during the past year, and stimulated interest which cannot but result in increased progress during the coming year.

The first paper on the programme was on

Illuminating Engineering and Its Application to the Gas Industry, *by E. Leavenworth Elliott.*

The writer devotes several paragraphs to a general introduction, the purport of which is that the great industries have now been established on an engineering basis, and that the argument that because a trade has been able to exist without the application of science is no sufficient reason why it will continue to flourish under such conditions. The statement is made that "What was good enough yesterday is *not* good enough to-day, if there is something better to be had. This is the only doctrine upon which civilization can advance."

The question as to whether illuminating engineering applies to gas lighting is then answered as follows:

> To deny that there is a large and legitimate field for illuminating engineering in gas lighting is to assume that there is no further room for improvement in the production or use of gas light, a proposition which it would be difficult to maintain; and yet in face of its evident absurdity the statement has been repeatedly made. To the outside observer it appears that there is no part of the general field of illumination which is in such urgent need of illuminating engineering as gas lighting.

The neglect of the gas industry to take up illuminating engineering as vigorously as the electric interests have done is attributed partly to the fact that gas, being much the older illuminant, has suffered somewhat from the conservatism that is inevitable with advancing years, while electricity is still "an industry of young men." Speaking further on this subject, the writer says:

> The electric lighting interests, being young and eager for the fray, have taken advantage of every improvement and device afforded by science or art to push their lines forward, and have been keen to detect any weakness in the lines of their enemies. Illuminating engineering afforded a potent weapon with which to wield their fight for supremacy. Engineering is based upon commercial economy; and since economy was the one stronghold of gas light, any means of offsetting this advantage was particularly welcome; hence the immediate acceptance of illuminating engineering by those at the front in the electric lighting field.

Coming to the subject of illuminating engineering, the author states that he proposes to treat the subject in the broadest possible manner, and that illuminating engineering "takes into consideration the artistic, physiological and psychological problems connected with light, as well as the mechanical and economical problem. It considers quality as well as cost." Among the first things to be looked after, in the author's opinion, is the question of better fixtures, upon which question the following arguments are made:

> In the course of one generation the electric fixture has emerged from its initial hiding place, and occupied the field alone, so far as artistic quality is concerned. This does not mean that there are no artistic gas fixtures, but such as there are, are adaptations of electric designs.
>
> It is the practically universal opinion today among users that gas lighting is necessarily inartistic, at least as compared with electricity. Right here is the point where illuminating engineering with gas ought to begin. The user must be shown that it is possible to obtain as artistic fixture designs with gas as with other illuminants. This requires two things: the artistic fixtures must be actually designed and made, and the consumer must be made aware of the fact of their existence. The fixtures will be produced by the manufacturers when there is a sufficient demand to justify the effort, and this demand must be wholly created by the gas lighting interests. It is immaterial to the fixture trade for what illuminant it makes fixtures, and it cannot have any possible interest in promoting one more than another; the initiative must be taken by the gas people.

On the future of gas lighting, and the means of maintaining it against competing illuminants, the writer expresses himself as follows:

> Gas light has been practically routed in

this country from the largest commercial buildings and industrial plants. Its one remaining stronghold is the private house, and this stronghold is being vigorously attacked by competing illuminants. . . .

While it would be a comparative waste of effort to attempt to supplant electric light with gas light in the best class of commercial buildings, there is no occasion to abandon the field in the less pretentious cases, and such cases are not confined to third or fourth rate buildings. There are innumerable cases in which gas lighting would be used if it were not for the generally held opinion that it brands the place as second-class. If it were understood that gas lighting installations could be used which the observer would never discover were gas, it would go a long way toward securing favor for commercial use. From the illuminating engineering standpoint nothing is easier to do than this; in fact, it is a settled principle of illuminating engineering that the source of light itself should not be visible, all modern light-sources being too dazzling for direct view. Such being the case there is no reason for the observer knowing what illuminant is used. Now that the incandescent electric lamp seems destined to rapidly displace the carbon arc for interior illumination the distinguishing differences between gas and electric light, viz., the color of the light and appearance of the lamp, will disappear. As to color there is no practical difference between the tungsten lamp and a good incandescent mantle.

From the various propositions and arguments set forth, the following conclusions are drawn:

When simmered down the proposition amounts to this: Illuminating engineering applied to gas light means that each installation will be put in such a manner as to give gas all the advantages of which it is capable in economy, appearance and quality of illumination produced. This result cannot be obtained without such a familiarity with the subject of lighting as may fairly entitle its possessor to be called an illuminating engineer. As to its relation to the gas industry, it is precisely the same relation which efficient service in any business bears to the success of that business. Gas light would undoubtedly continue to be used for some time to come on the old hit-and-miss basis, but the more intelligently it is utilized the longer will it lead a prosperous existence. Between doing a thing in the best possible manner, and in just doing it somehow, there is a wide difference, which generally measures the exact distance between success and failure. If it is admitted that gas lighting could be better done than it generally is at present, then it must also be admitted that it has need of illuminating engineering. To claim that it is not in need of this use of applied science can only be justified for one of two reasons: either gas lighting is now being done perfectly without such aid, or it is too far gone to be resuscitated. You may take either horn of the dilemma you choose.

Included with the paper is a table giving an analysis of the new business activities of twenty-five gas companies for the years 1908, 1909 and 1910. This is from figures furnished by the gas companies themselves, and contains much interesting matter that may well furnish food for thought for the gas interests. It shows that seven of the twenty-five companies regularly employ an illuminating engineer, to whom the title is given, and the same number make systematic use of illuminating engineering in their new business departments. The proportion of gas used for lighting to that used for other purposes is evidently diminishing in a larger ratio than it is increasing for other purposes, which indicates a slight falling off in the use of gas for illumination. All of the companies but one express their faith in the future of gas lighting; the opinion of this exception is to the effect that gas will be gradually supplanted by electricity as an illuminant. The paper resulted in a most animated discussion, a number of the members being particularly anxious to challenge the statement made by the writer in his summing up of the discussion that there was not a complete installation of gas lighting in any first-class building in the great cities. While this statement was not successfully refuted, the fact was brought out that, especially within the past year, large and important gas lighting systems have been installed both in industrial plants and commercial buildings.

THE MODERN GAS FIXTURE, *by Charles E. Ummach.*

Although the briefest paper presented, the writer presented the subject in such a condensed and terse form that it was one of the most important contributions to the convention. It is difficult to abstract so concise a document, but the following paragraphs are particularly worthy of attention:

Electric companies in order to promote the sale of their product introduced a classy, up-to-date decorative effect in lighting fixtures, and the gas companies at no particular time have devoted much energy to promote the sale of their product by the use of gas

lighting appliances; therefore, as they were unfamiliar with what actually existed in the way of lighting effects and allowed themselves to be forced to a condition of severe competition, through the efforts of the electric companies . . . the gas companies, being confronted with such conditions determined to hold what they had, get back what they lost and solicited in new fields for the purpose of selling more gas. The idea, no doubt, was a good one and quite necessary, but the methods adopted were not of the best, as the slogan was quantity and *not quality,* the result appearing in the form of cheap gas fixtures, as the manufacturers were not encouraged to make a better grade of fixtures, the sale of which became practically a dead issue, and they immediately put their force of designers and mechanics to work on electric fixtures, as the electric companies kept right after the consumer with an educational plan of better goods, better light and better service. . . .

There is an open field, an ever broadening outlook for gas lighting, and aside from possibly a few overcrowded centers, gas will always be one of the chief sources of illumination. Wealth is increasing, culture becoming broader, and the knowledge for the best and desire for the best in the home is growing more acute, an energy equal in quantity and quality to that squandered on the propaganda (of gas for fuel) will go far to wrest the banner of lighting supremacy from the electric fixture, and actual co-operation between gas companies and fixture manufacturers is positively needed. *Mere cheapness must be forgotten.* Tell your consumer something of *good light,* its possibilities, both as a decorative element and as a dollar for dollar investment, its greater efficiency, and the result will do much to encourage the gas company as well as the fixture manufacturer.

Comparative Costs and Efficiency of Gas, Electric and Gasoline Lighting.

By W. M. Blinks.

This paper is, to a considerable extent, a direct answer to the report of the Committee on Competitive Illuminants, presented at the last convention of the National Electric Light Association. The first criticism made on this report is, that whereas the costs of electric light were based upon laboratory tests, the costs of gas illumination were figured on operating installations. The writer discusses the subject of operating versus laboratory efficiency to some length, quoting the electrical journals to show that electric lighting units deteriorate in use unless careful attention is given to maintenance. Various publications are cited to show the relative cost of gas and electric light, in which gas shows to good advantage. As to the relative merits of gas and electric lighting the writer draws the following conclusion:

> Gas lamp efficiencies are becoming greater, mantle efficiencies are increasing, costs are decreasing, gas is selling at lower rates; supplement this with recognized superiority in color, low intrinsic brilliancy, better diffusion and ideal natural distribution of the modern inverted gas lamp and the future of gas lighting cannot be considered imperiled.

Gasoline lighting is then discussed and compared from the viewpoint of cost, convenience and safety. The paper is written with an evident intention to be absolutely fair in its statements, and furnishes the best document yet produced for the gas interests as an answer to the papers on the same subject that have emanated from electrical sources, and is one which should be carefully studied by the independent illuminating engineer.

The Illuminating Engineering Society

Philadelphia Section.

The first meeting of the season of the Philadelphia Section of the Illuminating Engineering Society was held in the Assembly Hall of the Philadelphia Electric Company's Building, 1000 Chestnut Street, on Friday, October 20, 1911.

The usual dinner preceding the meeting was held at Mosebach's restaurant, 929 Market Street, 50 members and guests being present.

The meeting, which was attended by 110 members and 58 visitors, was called to order by the chairman, Mr. J. D. Israel, at 8 o'clock.

The chairman concluded his introductory remarks by introducing Prof. Sydney W. Ashe, of the General Electric Company, who was the speaker of the evening and delivered an illustrated paper on "Training of Commercial Men in the Fundamentals of Illumination." Prof. Ashe gave a short history of the work which has been done in educating commercial men, by large corporations, stating that Germany has been the pioneer in this work. In the second part of his lecture Prof. Ashe showed, by means of interesting experiments and lantern slides,

the various steps taken in the education of the commercial man. The discussing was participated in by Mr. Henderschott, Prof. Rowland and others.

The entertainment, which followed the paper, consisted of moving pictures showing the manufacture of the Welsbach mantle, also the manufacture of the incandescent electric lamp.

The exhibition provided, which consisted of a demonstration of electric meters and an exhibition of new appliances pertaining to the generation, distribution and use of gas and electric illumants, proved of interest to everyone.

The November meeting of the section was held in the Assembly Hall of the Philadelphia Electric Company's Building, 1000 Chestnut Street, on Friday, November 17, 1911.

The usual dinner preceding the meeting was held at Mosebach's, 929 Market Street, and was attended by 48 members and guests. After the dinner, the party adjourned to the Lecture Hall to examine the exhibition of the latest type of incandescent gas lamps and appliances. These appliances were explained and demonstrated later in the evening by Mr. R. F. Pierce, of the Welsbach Company.

The meeting was called to order at 8 P. M. by Mr. Joseph D. Israel, chairman, 122 members and 66 visitors being present.

The first speaker of the evening was Mr. E. J. Brady, who delivered a paper on "A Comment on the Application of Photometric Data to Interior Illumination." This paper, while short, proved very interesting and was followed by some little discussion.

The second paper of the evening was delivered by Mr. George S. Barrows on "Natural Gas, its Production and Utilization." This paper, which was profusely illustrated with lantern slides, proved of great interest to those present.

The papers were discussed by Messrs. C. O. Bond, I. N. Knapp, George B. Muth, Professor Rowland and others.

Cleveland Section, A. I. E. E.

On Monday evening, October 23, the Cleveland Section of the A. I. E. E. held its regular monthly meeting in the auditorium of the Engineering Building of the National Electric Lamp Association, at the invitation of the latter. The technical programme consisted of a paper on "Industrial Lighting," by Mr. C. L. Eshleman, of the Adams-Bagnall Electric Company, and a paper on "The Choice of an Illuminant," by Mr. Irving H. Van Horn, of the Engineering Department of the National Electric Lamp Association, followed by discussion on both of these papers.

Mr. Eshleman treated his subject from the standpoint of efficiency engineering, and cited statistics and personal experiences tending to prove the sacrifice of output and quality and the greater percentage of accidents in poorly lighted factories and the relatively low cost of good illumination when compared with the value of its benefits. His paper will shortly be issued in printed form. Mr. Van Horn gave a detailed analysis of the qualifications which an illuminant should possess, and gave the results of some recent tests to determine the critical frequency of visible flicker for various kinds of incandescent lamps. Both papers were illustrated by the stereopticon.

After the technical session a collation was served and a social hour was enjoyed. About 105 were present.

"Some Features of Good Steel Mill Illumination."

By Ward Harrison

A Paper Read Before the Association of Iron and Steel Electrical Engineers at the Convention Held in New York City, September 29.

Although a very brief paper, the analysis of the subject of illumination in relation to mechanical efficiency and the efficiency of those operating under it is exceedingly clear and complete. After remarking that it is possible to accurately measure the efficiency of a generator or engine since the input and output of determined quantities, the writer states the difficulties in a similar determination of the efficiency of a lighting problem. The paper is the best condensed statement of the general problem that we have yet seen.

American Items

New Books

ILLUMINATION—ITS DISTRIBUTION AND MEASUREMENT, by Alexander Pelham Trotter; 292 pp., cloth; price $2.75 net. Published by the Macmillan Co., New York.

This book will be reviewed in our coming January number.

ARC LAMPS AND ACCESSORY APPARATUS, by J. H. Johnson, 135 pp., cloth; price 75 cents net. Published by D. Van Nostrand Co., New York.

This book will be carefully reviewed in our coming January number.

CLEVELAND INCANDESCENT LAMP COMPANY CASE; *Electrical World*, October 21.

DECORATIVE LIGHTING IN SPRINGFIELD, ILL., DURING THE STATE FAIR; *Electrical World*, October 21.

THE CENTRAL STATION OFFICE BUILDING ILLUMINATION; *Electrical World*, October 21.

FINAL DISPOSITION BY PATENT OFFICE OF HEANY TUNGSTEN LAMP CASES; *Electrical World*, October 28.

THE INCANDESCENT LAMP SITUATION; *Electrical World*, October 28.

EFFECT OF REFLECTION FROM FLOORS, by J. R. Cravath; *Electrical World*, October 28.

The writer calls attention to the very appreciable effects which reflection from floors have upon the general illumination in a room. In the case of a certain ball room, which is sometimes used as an auditorium, the difference in the lighting of the faces of the people present is distinctly seen when the floors are covered temporarily with a dark green covering when the room is used as an auditorium. The case of a printing plant lighted with opaque reflectors and tungsten lamps, which give no direct light on the ceiling, is given as a case of unusual floor reflection, the light being sufficient to illuminate the ceiling fairly well.

DECORATIVE STREET LIGHTING IN HAMILTON, OHIO; *Electrical World*, October 28.

VISUAL ACUITY AS AFFECTED BY PUPILLARY ATTRACTION, by S. W. Ashe; *Electrical World*, October 28.

COLOR CORRECTION FOR LIGHT OF MERCURY ARC LAMPS; *Electrical World*, November 4.

CANDLE-POWER LIFE PERFORMANCE OF INCANDESCENT LAMPS, by G. S. Merrill; *Electrical World*, November 4.

A letter to the editor in which the writer goes over the entire subject of pupillary contraction as related to acuity of vision, citing all the principal investigators that have worked along these lines. The writer is not yet satisfied from the results of experiments reported that acuity of vision is not affected by this cause.

REMOTE CONTROL OF ORNAMENTAL BLOCK LIGHTING AT PEORIA, ILL.; *Electrical World*, November 11.

VISUAL ACUITY AND PUPILLARY APERTURE, by Dr. Louis Bell; *Electrical World,* November 11.

A letter to the editor in which the writer replies to the previous letter of Prof. Ashe explaining why, in his own experiments reported in the *Electrical World,* May 11, the effect of pupillary contraction was absolutely eliminated. This was accomplished by using an apparatus in which the two fields of vision illuminated by the two different light-sources were viewed simultaneously by the same eye. Both Dr. Bell and Prof. Ashe agree as to the merits of the flicker photometer for measuring lights of different colors. The writer refers to Ludwig Bach's "Pupillenlehre" as a very complete resume of the present knowledge of the subject.

THE DEPENDENCE OF VISUAL ACUITY ON THE WAVE LENGTH OF LIGHT, by M. Luckiesh; *Electrical World,* November 18.

ADVANCED TYPE OF WAITING ROOM SEAT LIGHTING; *Electrical World,* November 18.

VISUAL ACUITY AND LIGHT OF DIFFERENT COLORS, by M. Luckiesh; *Electrical World*, November 18.

A somewhat extended article describing fully further experiments carried out by the writer to determine the effect of the color of light upon visual acuity. The article is illustrated with a complete diagram of the apparatus used and curves showing results obtained.

The experiments carried out, which the writer admits are not absolutely conclusive though undoubtedly valuable, indicate that defining power is about equally low at the two ends of the spectrum and increases toward the middle, the maximum appearing in the region of the yellow. Although the writer does not draw attention to the fact, it is interesting to note that maximum acuity and maximum visual effect are practically coincident, according to the results obtained by this investigator.

A letter to the editor in which the writer replies to Mr. Dow's contention that the eye is more easily focused for blue than for red rays in the case of near vision, and the reverse for distant vision. The writer admits that this is true for extremely large and extremely short distances, but for intermediate distances this difficulty of accommodation practically disappears.

SOME OPERATING CHARACTERISTICS OF METAL FILAMENT LAMPS, by J. Frank Martin; *Electrical Review* and *Western Electrician*; November 11.

WIRING AND LIGHTING OF A LARGE THEATRE, by Z. C. Adams; *Electrocraft*, November.

A FINE FACTORY INSTALLATION; *Electrocraft*, November.

ORNAMENTAL STREET LIGHTING IN PINE BLUFF, by M. Q. Woodward; *Electrocraft*, November.

PLAIN TALKS ON ILLUMINATION; *Electrocraft*, November.

A NEW DEPARTURE IN THE DECORATIVE LIGHTING OF AMUSEMENT PARKS, by G. A. Barker; *Southern Electrician*, November.

LOUISVILLE TO INCREASE STREET ILLUMINATION; *Selling Electricity,* November.

EFFECTIVE RESIDENCE STREET LIGHTING AT NORTH YAKIMA; *Selling Electricity*, November.

PINE BLUFF CELEBRATES COMPLETION OF WHITE WAY; *Selling Electricity,* November.

DECORATIVE STREET LIGHTING IN PASCO, WASH.; *Selling Electricity*, November.

PINE BLUFF'S GREAT WHITE WAY; *Southwestern Electrician*, November.

WINDOW LIGHTING BY ANGLE REFLECTORS, by J. Augustin; *Progressive Age*, November 1.

LIGHTING SCRANTON'S PUBLIC SQUARE; *Progressive Age*, November 1.

REFLEX LIGHTS FOR COMMERCIAL USE, by S. B. Palmer; *Progressive Age,* November 15.

ARTIFICIAL ILLUMINATION OF A TENNIS COURT BY HIGH PRESSURE GAS; *American Gas Light Journal,* October 23.

HOSPITAL LIGHTING, by E. H. Bostock; *American Architect,* October 18.

A short article in which the author runs over the subject in a necessarily superficial manner. Both natural and artificial light are dealt with, but only in the most general way, the only new matter being the description of an extending bracket intended to hold two electric lamps which, when not in use, may be shoved back into a recess in the wall.

SHOW CASE AND WINDOW LIGHTING, by William S. Kilmer; *Dry Goods Reporter,* October 21.

HOW SCIENTIFIC LIGHTING REDUCES EQUIPMENT COST, by Allen E. Beals; *Record and Guide,* November 4.

LEARNING TO USE LIGHT, by Charles Frederick Carter; *Technical World Magazine,* November.

A popular profusely illustrated article showing cases of good and bad lighting, according to the writer's opinion, and giving a number of statistics concerning the lighting industry.

VISUAL REQUIREMENTS IN THE PUBLIC SERVICE, by William Campbell Posey; from the *Journal* of the American Medical Association; reprinted in the *Optical Journal and Review,* November 2 and 16.

USE OF TUNGSTEN LAMPS IN SIGN LIGHTING, by W. B. Goudey; *Public Service,* November.

INTERIOR LIGHTING, NATURAL AND ARTIFICIAL, by Putnam A. Bates, *Scientific American,* October 28.

INDIRECT ILLUMINATION, by J. A. Hoeveler; *Wisconsin Engineer,* November.

The writer subheads his title "Physiological Reasons Why Indirect Illumination Is Desirable." A well written article containing many interesting references to indirect lighting systems in different parts of the world, with illustrations and a careful and fair analysis of the advantages and disadvantages of this method of illumination.

The following is of interest:

That indirect illumination is a very desirable system of lighting for many interiors is by no means a new idea. As early as 1881 an indirect illumination system made its appearance at the Paris Electrical Exhibition of that year. Jasper, its inventor, used arc lamps with conical white reflectors of nickel iron placed beneath the lamp. A German engineer, Schuckert, adopted the same idea and installed Jasper's system in two drawing schools in Leipzig in 1885. Later he also installed the system in the Industrial School, in the Anatomical School of Vienna, and in the Architectural School of Nürnburg. Erissmann, of Moscow, first introduced indirect illumination in Moscow, using petroleum lamps. Professor Rank, of Halle, used arc lamps with opaque white reflectors of a hemispherical shape in his lecture room. In 1893 he substituted white milk glass reflectors and obtained an efficiency 10 per cent. higher than that obtained with the opaque reflectors. F. Kermaner and W. Prausnitz used Welsbach's incandescent gas lamps with conical milk glass reflectors for school room, lecture room and work room purposes in 1897. One of their most notable installations was the "Hygienic Institute," of the University of Graz. In 1908 an indirect system was installed in the waiting room of the Union Depot, Washington, D. C. In this system arc lamps were used. Since the recent introduction of a new system of indirect light, which employs tungsten lamps and specially designed silver-plated reflectors in centrally located fixtures, indirect illumination is coming into more and more extensive use, and a choice between direct and indirect light has become a real engineering problem.

Editorials

ENDING OF FEDERAL INCANDESCENT LAMP SUIT; *Electrical World,* October 21.

LIFE OF METAL FILAMENT LAMPS; *Electrical World,* October 28.

WORK-SHOP LIGHTING; *Electrical World,* November 4.

THE RADIATION PROPERTIES OF INCANDESCENT LAMPS; *Electrical World,* November 4.

VISUAL ACUITY AND COLORED LIGHTS; *Electrical World,* November 18.

LEGISLATION RELATIVE TO ILLUMINATION; *Electrocraft,* November.

RAILROAD YARD LIGHTING; *Electrical Review and Western Electrician,* November 18.

EVOLUTION OF THE LAMP; *Southwestern Electrician,* October.

VISION AND PERCEPTION; *Optical Journal and Review,* October 19.

SUNLIGHT AND OTHER KINDS OF LIGHT; *Optical Journal and Review,* October 26.

Foreign Items

COMPILED BY J. S. DOW.

Illumination and Photometry

ON THE PERCEPTION OF LIGHTS AT SHORT DURATION AT THEIR RANGE LIMIT, by A. Blondel and J. Rey (*Illum. Eng.,* London, October and November, 1911).

This article contains an account of researches on flashing lights used at sea. The authors study the physiological effects of such lights on the retina of the eye and form some general conclusions as to the duration the flashes should have, so as to be as easily perceived at a distance as possible.

UEBER DIE EINWIRKUNG DER ULTRAVIOLETTEN STRAHLEN AUF BAKTERIEN, by O. Bujwid (*J. f. G.,* September 2).

UEBER WASSERSTERILISIERUNG MITTELS ULTRAVIOLETTEN STRAHLEN, by Erlwein (*J. f. G.,* September 30).

The above two articles both deal with the effect of ultra-violet rays on bacteria, In the first named paper there is a valuable compilation of the literature on the subject, arranged in historical order and the modern value of this method for treating the water supply of large towns and so avoiding the possibility of such scourges as cholera is dwelt upon.

THE INTERNATIONAL OUTLOOK IN SCIENTIFIC ILLUMINATION, by L. Gaster (Paper read at the Int. Elec. Congress in Turin; *Illum. Eng.,* London, October).

In this paper a review was given of the many problems, some of an industrial nature, others concerned with the symbols and nomenclature of illuminating engineering on which international co-operation is needed. It is pointed out that there are at present a number of separate societies, committees and institutions (such as the Illuminating Engineering Societies in Great Britain and in the United States, the International Photometrical Commission, the International Electrotechnical Commission, etc.), which are interested in these subjects, but at present proceed on separate lines. What is needed, therefore, is a central organization on which these bodies should be represented, which can gather the work together and make recommendations with the necessary international and impartial authority.

STUDIES IN LIGHT PRODUCTION, by R. A. Houstoun (*Electrician,* September 8, 15, 22, 29).

This is a serial article in which the theory of light production is treated. The first of the series deals with the measurement of luminous efficiency and its definition. Others study the radiation from a black body, the incandescent mantle, electric lamp filaments and other modern illuminants.

WORKSHOP LIGHTING, by W. Manktelow (*Elec. Rev.,* October 6).

This article contains an excellent summary of data recently published on factory lighting. The author comments on the existing legislation, pointing out that even where "adequate illumination" is specified, the specification is couched in very vague and general terms. He, therefore, urges the necessity of actual measurements of illumination, and presents an excellent

collection of results obtained by various authorities in Europe and America for lighting various kinds of premises (spinning works, textile factories, sewing machines, etc.).

An International Committee on Illumination (Editorial, *Illum. Eng.*, London, October).

This deals with two most important resolutions passed at the recent meetings in Turin of the International Electrotechnical Commission and the International Electrical Congress.

That passed at the Commission was moved by Mr. Leon Gaster, and received the support of Dr. C. H. Sharp and Prof. A. E. Kennelly. The resolution was to the effect *that the National Committees should co-operate with the Illuminating Engineering Societies in their respective countries in studying the question of symbols, nomenclature and other matters relating to illumination.*

The resolution subsequently passed at the general plenary meeting of the International Electrical Congress was, like the former, carried unanimously, and ran as follows: *That this Congress deems it desirable that an International Commission should be appointed in order to study all systems of lighting and technical problems in connection therewith; and having been informed that the Illuminating Engineering Society of London has the intention of forming such a Commission, and of putting itself in touch with the other existing national and international photometric committees, approves their taking the initiative in this respect.*

It need not be said that these are two exceedingly important resolutions, and it is specially to be noted that an electrical congress has seen the wisdom of sanctioning the appointment of an international committee to deal with *all* illuminants.

The Value of Illumination to Railway Companies (*Illum. Eng.*, London, October).

Contains some figures showing the large scope for illuminating engineering in railway lighting. Most of the important railways, recognizing this, have appointed special departments to deal with lighting. The article also makes reference to some recent publications in the *Railway Gazette* and elsewhere, giving comparative costs for gas and electric lighting.

The Illumination Required for Various Purposes (*Illum. Eng.*, London, October).

Contains some tabulated data, drawn from various papers in Great Britain, the United States and on the Continent, showing the amount of illumination which various authorities have thought desirable for different purposes.

Light and Shade in Indirect Lighting (*Illum. Eng.*, London, October).

Some correspondence between Mr. A. J. Marshall and Mr. J. Eck. The former comments upon some recently published tests by Mr. Eck, demonstrating that a white sphere is quite distinguishable from a white disc of similar diameter when placed in a room lighted by indirect arcs. These tests are now repeated with the disc and sphere side by side, and it is shown that the shade is still clearly seen on the latter while the disc is plain. In short, it bears out the contention that indirect lighting is not shadowless, but merely gives soft shadows.

Das Aronsche Chromoskop (*Z. f. B.*, September 30).

A description of the small instrument for color matching recently referred to in these columns, and depending on the use of polarized light.

Int. Lichtmesskommission (*J. f. G.*, October 14).

Electric Lighting

Electricity in Cinematograph Theatres, by A. E. Brewerton (*Elec. Rev.*, August 25).

The author points out the enormous waste that often occurs in cinematograph lighting, especially in the case of lamps run on a high voltage; in such cases it is often economical to use a motor generator to cut down the P. D. to the desired amount.

Luminescent Tubes Containing Neon, by G. Claude (*Comptes Rendus*, 152 pp., 1377-1379, May 22).

Describes a new form of vapor tube system of lighting in which the rare gas Neon

is utilized. The inventor states that it is possible to do without the use of the special valve letting in air at intervals, which is a feature of the Moore tube. A difficulty has been the rapid volatilization of the electrodes, but it is stated that this is largely overcome by using a low current density. The tube is of comparatively small dimensions, lengths of six meters or so being used, and the color appears to be a bright orange-red.

THE AMOUNT OF ULTRA-VIOLET RAYS YIELDED BY THE QUARTZ TUBE MERCURY VAPOR LAMP FOR DIFFERENT POWER CONSUMPTIONS, by Henri (*Comptes Rendus*, July 24).

It has been found that the intensity of the ultra-violet energy given by quartz tube mercury vapor lamps diminishes rapidly with use. The author suggests that this may be due to a slight gray deposit which gradually forms on the inner surface of the tube.

DIE LICHTSCHWANKUNGEN VON MIT WECHSELSTROM GESPEISTEN GLÜHLAMPEN, by F. Kesseling (*Elek. u. Masch.*, August 27).

A mathematical study of the fluctuations in light of glow lamps on alternating current circuits. The main conclusion seems to be that low voltage high candle-power lamps are best used if the frequency is low.

EFFECT OF SWITCHING ON AND OFF ON THE LIFE OF GLOW LAMPS, by Prof. E. W. Marchant and W. Parry (*Illum. Eng.*, October).

These tests form some supplementary data to the paper read by the author before the Illuminating Engineering Society (London) in December, 1910. The apparatus is described in some detail, and the author reaches the conclusion that the amount of switching on and off that lamps are likely to receive in ordinary practice would not have any material effect (probably under ½ per cent.) on their life and efficiency.

THE OSRAM LAMP AND ITS APPLICATIONS, by H. Remané (Paper read before the Schweizerische Elektrot. Verein; *Electrician*, September 1).

The paper contains the results of inquiries addressed to 185 different towns on the subject of street lighting by Osram lamps. The author shows that after due allowance for renewals, etc., carbon filament lamps can, in general, be replaced by metallic filament lamps of double the candle-power and yet a saving made. The lamps are also proving serviceable in many localities where there is considerable vibration, such as collieries, etc.

LAMPS À FILAMENTS METALLIQUES ET TRANSFORMATEURS, by M. de Rossi (*l'Electricien*, September 9).

DIE STRAHLUNGSEIGENSCHAFTEN ELEKTRISCHER GLÜHLAMPEN, by A. Russner (*E. T. Z.*, October 12).

Describes some additional tests on the luminous efficiency of carbon filament and metallic filament glow lamps, which he gives as 1.5 and 4.5 per cent., respectively.

WIE SIND ELEKTRISCHE UND GASBELEUCHTUNG HYGIENISCH ZU BEWERTEN? by K. Schlesinger (*E. T. Z.*, September 21).

THE ELECTRICAL EXHIBITION AT OLYMPIA (*Illum. Eng.*, London, November).

MERCURY VAPOR LAMPS YIELDING WHITE LIGHT (*Illum. Eng.*, November).

This article contains a summary of the methods used to improve the color of the mercury arc lamp (using a combination with carbon filament lamps, adding special metals to give red lines in the spectrum, etc.). The most satisfactory method yet developed is the new Cooper Hewitt rhodamine reflector which fluoresces and gives a red color.

Gas, Oil and Acetylene Lighting

AUSGEWÄHLTE BEISPIELE AUS DEM VORDRINGEN DES GASES IN KLEINSTADT UND GROSSTADT, by A. Albrecht (*J. f. G.*, October 7).

The paper contains a number of illustrations of modern gas installations, one

of the most interesting showing the use of inverted lighting in a modeling room.

STREET LIGHTING FROM A PRACTICAL POINT OF VIEW, by H. E. Copp (*Gas Engineers' Magazine,* September 15).

FORTSCHRITTE AUF SPIRITUSBELEUCHTUNG, by O. Mohr (*J. f. G.,* September 23).

ERFAHRUNGEN BEI DER EINRICHTUNG DER FERNZÜNDUNG, by H. Metzger (*J. f. G.,* August 26; *Illum. Eng.,* London, November).

A very interesting account of experience with distance gas lighting and its effect on gas supply works. The author discusses the merits of the clock work, electric and pressure devices, and describes a series of tests on two forms of apparatus of this kind. He shows that in course of time the percentage of failures was reduced to 1 per cent., and gives figures demonstrating the saving accomplished in mantles, chimneys and wages of men employed in lighting up.

EINIGES UEBER KUNSTSEIDE GLÜHKORPER, by Nass (*J. f. G.,* September 23).

Gives some account of progress in artificial silk mantles which is illustrated by microphotographs of the fabric after burning for 1000 hours. He contends that the web holds together much better than in the case of ramie or cotton mantles, mainly because the individual fibers are considerably longer.

STRUCTURE OF INCANDESCENT MANTLES, by J. A. Zdanonich (*J. G. L.,* August 26; September 19).

An article on very similar lines to the above, describing another form of artificial silk mantle.

FITTINGS AND SALES DEPARTMENT, by R. H. J. Rogers (*J. G. L.,* October 17).

A paper dealing with the education of salesmen, the rise of high pressure lighting, the specification of pressure at consumers' premises and many other subjects of present interest in the gas industry.

SUGG HIGH C. P. LOW PRESSURE LAMP (*J. G. L.,* September 29).

THE NICO LOW PRESSURE LAMP (*G. W.,* September 2; *J. G. L.,* August 29).

Two very interesting new low pressure lamps which are stated to give as much as 40 c.-p. per cubic foot. This great improvement is ascribed mainly to the judicious preheating of the air and gas mixture.

BAMAG ARTIFICAL SILK MANTLES (*G. W.,* August 26).

REPORT OF THE SOCIÉTÉ TECHNIQUE DU GAZ (*J. G. L.,* September 26).

HIGH PRESSURE GAS LIGHTING AT ILFORD (*G. W.,* September 30).

ZUR THEORIE DES GASGLÜHLICHTS (*J. f. G.,* October 14).

DIE ERSTE GASBELEUCHTUNG IN BERLIN (*Z. f. B.,* September 30).

NEUERUNGEN AN INVERTBRENNERN (*Z. f. B.,* August 20; September 10, 20; October 10, 20).

PETROL AIR GAS AS AN ADJUNCT IN COAL GAS MANUFACTURE (*G. W.,* September 9).

L'ECLAIRAGE DE VILLES PAR ACETYLÈNÈ (*Rev. des Eclairages,* August 30).

L'ECLAIRAGE DES AUTOBUS PAR ACETYLÈNÈ (*Rev. des Eclairages,* August 30).

BELEUCHTUNG MIT FLÜSSIGEN LEUCHTMATERIALEN (*Z. f. B.,* August 30).

Contractions used:
E. T. Z. *Elektrotechnishe Zeitschrift* (*Berlin*).
G. W. *Gas World* (*London*).
Illum. Eng. Lond. *Illuminating Engineer* (*London*).
J. f. G. *Journal für Gasbeleuchtung* (*Berlin*).
J. G. L. *Journal of Gaslighting* (*London*).
Z. f. B. *Zeitschrift für Beleuchtungswesen* (*Berlin*).

The Illuminating Engineer

Vol. VI JANUARY, 1912 No. 11

GOOD LIGHTING

"Prove all things; hold fast that which is good."

The word "good" owes its significance entirely to an applied contrast. If it were not for the existence of the bad there would be no occasion to characterize a thing as "good." The word, moreover, not only expresses simple existence, but denotes progress. That which is bad signifies ignorance, prejudice, and stagnation; that which is good implies the intelligence to choose, the knowledge of moral and physical worth, and the desire to improve.

The frequent use of the word in connection with the vital elements of civilization, as "good health," "good government," and "good art," has a deeper meaning than the mere dictionary definition. It is proof of an underlying purpose among the people to place the social state on a higher plane.

The term "good lighting," therefore, not only implies the existence of poor lighting, but stands for an application of the scriptural injunction, which is as true to-day as it was two thousand years ago. "To prove all things" is the whole duty of the scientist; and to enable mankind to "hold fast that which is good," by showing the difference between the good and the bad, is the inestimable boon which science bestows upon society.

Illuminating engineering is a part of the great field of natural science, the purpose of which is to put all methods and means of lighting to the test, and determine that which is good. Light is one of the universal necessities of civilized man, and illuminating engineering thus contributes to the welfare of the whole human race by its labor to show what is good lighting.

But it is quite as essential that the work of the scientist be put within reach of the people as that the investigations should be made. Illuminating engineering has but a single aim: To insure the widest possible use of good lighting.

That there may be no mistake in this ultimate object, which is the fundamental purpose of this magazine, the explanatory phrase is now set forth under the "official" title on the cover. This is only to emphasize the principle for which we have always contended—THE USE OF MORE AND BETTER LIGHT.

E. L. Elliott.

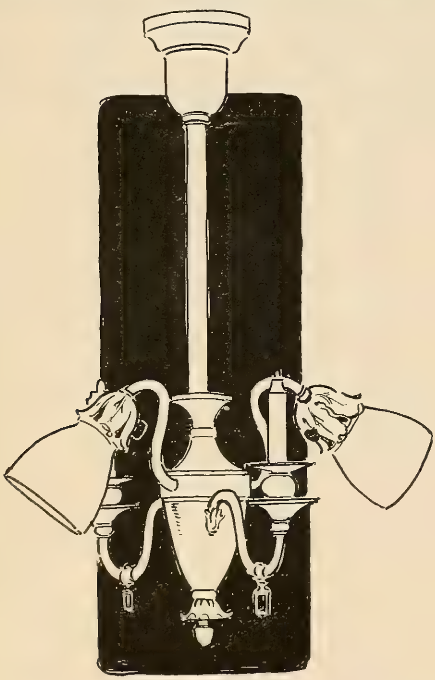
Good Reading Lights—And Bad Ones

How to Tell the Good from the Bad—And How to Get the Good

I. The Chandelier.

Have you a good reading light?

If this question were put at random to one hundred people it is probable that ninety-nine would answer, "No;" and the answer would probably be right. Reading is the one thing that causes more eye-strain by reason of improper or insufficient lighting than any other single task. This is due to several conditions which will be readily recognized. Almost every person reads to some extent, from childhood to extreme old age. Between the ages of six and twenty-one a large volume of reading is necessitated in the course of the regular school work. The majority of reading is done by artificial light; to have a good reading light is therefore the most important item in the whole range of artificial illumination.



A COMMON TYPE OF "COMBINATION" CHANDELIER. WASTEFUL AND HARD ON THE EYES.

The reason why good reading lights are so uncommon is not so easy to give. Perhaps the best explanation may be found in the well known proclivity of the human mind to accept without question the things it is most familiar with, and to turn to the unfamiliar and remote in its efforts at improvement. It is only within very recent times that it has been possible for everyone to have an artificial reading light that is practically as good as daylight, and we are still clinging to the customs of our ancestors who had nothing better than the candle and the little oil lamp; so that we continue to accept poor light as a sort of necessary evil, which we can endure smilingly or otherwise, according to our humor.

Let us then start out with the positive assurance that by the proper use of modern light-sources we can read at night with as little strain upon the eyes as by full daylight; and the corollary of the proposition may as well follow at once, viz., that the best of light costs no more than we generally pay for the poorest, and in any case is so inexpensive that its cost bears no comparison whatever with the comfort received and the safety afforded to the most precious of all the senses.

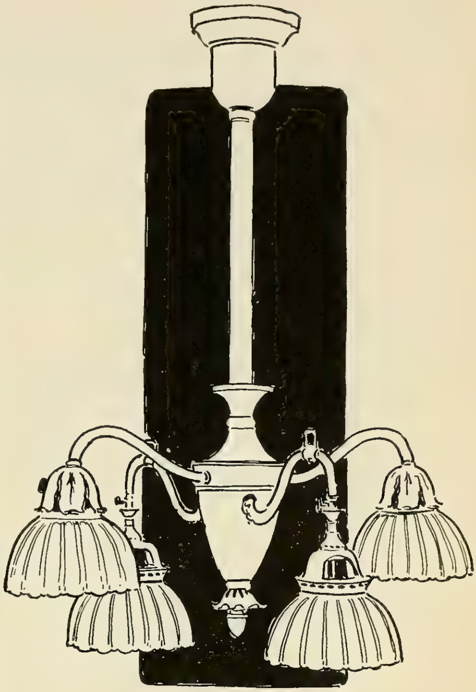
Let us also discharge our minds of any false notions of what constitutes good light by accepting the equally demonstrable fact that good light does not depend upon the use of some particular illuminant, but can be obtained equally well with electricity, gas, oil, or acetylene. Next after the admission that one's reading light is *not* good, the most common opinion is that the reason why it is not good is because it is electric, or gas, as the case may be. "This —light is very hard on the eyes" is a common saying; you can put in "gas" or "electric," according to which is used by the one expressing the opinion. "For comfort there is nothing like the old oil lamp" is another fallacy that is still prevalent; not that an oil lamp may not give

a very good reading light, but its light is no better than any other light equally well used. The fact of the matter is that there is no difference whatever in its effect upon the eye of the light produced by the candle, the kerosene lamp, the incandescent electric lamp, gas lamps of either the flame or mantle type, and acetylene gas: *it is not the light* but the *manner of its use that constitutes the difference between good and bad illumination.* How to *use* the luminant which is most convenient or available so as to produce the best illumination is therefore the whole problem.

The Common Way of Lighting a Room.

The most common way of lighting a room is by a chandelier suspended from the center of the ceiling. This may be arranged for gas or electricity or a combination of both, the combination being the most usual in the more modern houses. A very common construction for such a chandelier is two or three arms projecting downward at an angle of about 45°, supporting ordinary electric bulbs and some sort of ornamental glass shade, and the same number of arms equipped with imitation "candles" fitted with ordinary bat-wing burners. This arrangement is bad from every point of view. Electric lamps do not give out their strongest light through the end, as would be the natural inference from their angular position in this case, but through the side, and this strongest light is more or less absorbed and wasted by the alleged decoration of the "shades," so that even with three or four lamps burning the illumination underneath, where it is most generally used for reading, is insufficient and "spotty." If gas is used the flames are unsteady, which is one of the very worst faults that a reading light can have, while the light is prevented from shining below by the absurd candle-cups which are put under the burners from a mistaken notion of decorative art.

Furthermore, the arrangement is excessively wasteful of gas or electricity. The ordinary gas flame burns twice as much as a good mantle burner, and does not give one-quarter as much light; while a single modern electric lamp, sold in the market under the names of Mazda and tungsten, can be run with the same amount of current as the ordinary "bulbs," and give from two to three times as much light.



A SIMPLE CHANGE, AND WE HAVE THIS GOOD LIGHTING FIXTURE.

There are many variations of the chandelier, some better and some worse. In many cases the electric lamps are placed bolt upright, and in the more expensive types of fixtures the shades are often of colored glass, or otherwise decorated, and may absorb as much as three-quarters of the light. Right here let the reader avoid drawing the inference that we abjure all efforts at decoration in illumination; we do nothing of the kind, but we insist that it is the first business of a lighting fixture to give light. If it does this properly, as much art may be added as the individual user cares to pay for. It is perfectly possible to have the highest type of artistic effects with satisfactory results in illumination.

CONSIDERED ARTISTIC, BUT GIVES VERY POOR LIGHT.

How to Correct the Common Faults of the Chandelier.

In the case of a chandelier having any or all of these faults, what is the remedy?

There are several. One is to replace the chandelier with a type of fixture known as a "dome." This will involve an expense of from five dollars to two or three hundred dollars, according to your taste; but when figuring the cost of such a change do not forget that you will save enough in the cost of your light to pay handsomely on the investment, providing you are not too extravagant in your tastes. If you are living in a rented house also bear in mind that it is a simple matter to replace the old fixture, and take yours with you when you move.

The "Dome"

A dome serves the same purpose as a good table lamp, with the advantage of having no standard or base underneath. Many domes, however, are not properly constructed in regard to the arrangement of lamps. If you insist upon the following construction you will be sure of getting the best results with the least cost for gas or electricity:

If electric light is used the dome should be arranged to take a single Mazda or tungsten lamp, which should be fitted with a prismatic or opal glass reflector, and the lamp itself should be what is called "bowl frosted," i. e., have the lower part of the lamp bulb frosted. The old arrangement which provided for a cluster of lamps is very wasteful of light. A 60-watt tungsten lamp will give ample light under all ordinary conditions, and will use very little more current than a single 16 candle-power bulb.

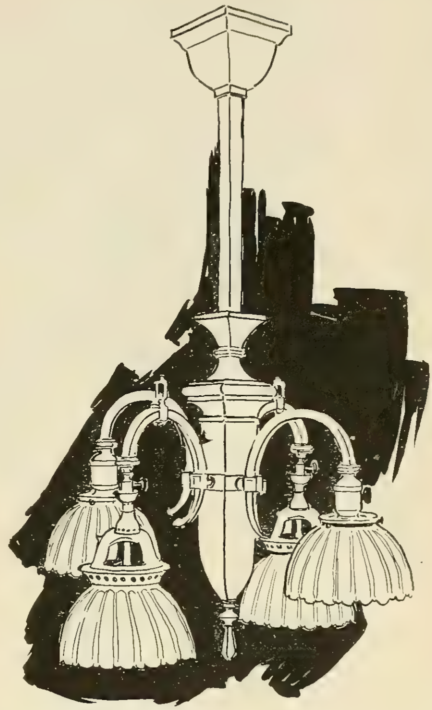
If gas is used the dome should be fitted with a single inverted mantle burner equipped with an opal glass or prismatic reflector. Such a burner will use less gas

CHANGING LAMPS AND SHADES PRODUCES AN EQUALLY ARTISTIC "SEMI-INDIRECT" LIGHTING FIXTURE.

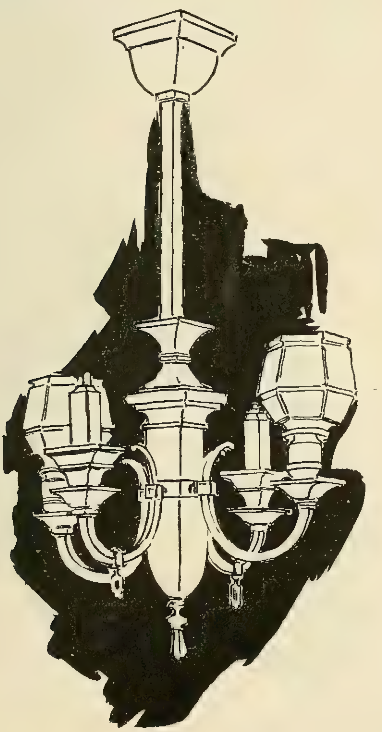
than an ordinary flame jet, and will give an abundance of light for either a dining or reading table.

The dome should be hung at such a height that the filament of the lamp or mantle of the gas burner will not be seen in the usual positions in which you would sit.

It is possible, however, to secure a good light without the expense of purchasing an entire new fixture. In many cases it is a simple matter to bend the arms of the chandelier so as to make the electric lamps hang vertically without even taking it down. Then, by using the small sized Mazda or tungsten lamps and good translucent reflectors, satisfactory results can be obtained. The lamps should be bowl frosted, and the reflectors should be of the deep, or bowl pattern, so as to cover the lamp as much as possible. If the electric lamps are placed straight upright, the electrician can frequently invert the arms of the fixture so that the lamps will hang pendant, when they can be treated in the manner just mentioned.



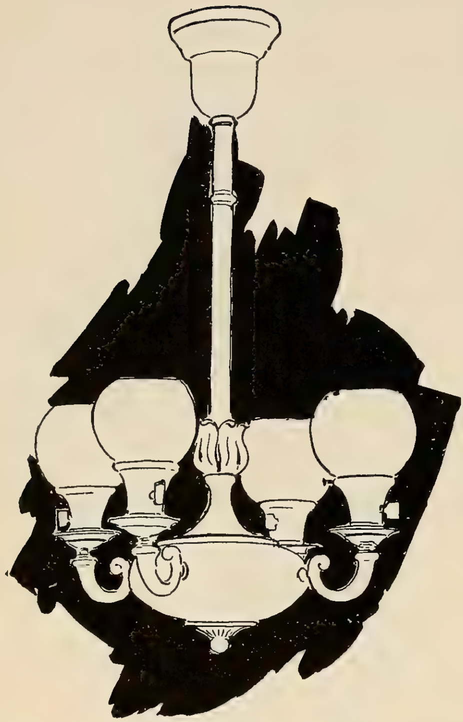
AN ARRANGEMENT GIVING A GOOD LIGHT AND BETTER TASTE.



A MISCONCEPTION OF ART WHICH GREATLY INTERFERES WITH USE.

What to Do with Imitation "Candles."

In the case of gas, the imitation candles can be very easily replaced with small upright mantle burners. These are very cheap, both in first cost and in the expense of running. They should be fitted with good diffusing globes or shades. The test for good diffusion in lighting glassware is that the form of the light-source, such as the mantle or filament, be entirely hidden. The advantage of these small burners is that three or four of them can be run on the same gas used by a single gas flame, and the appearance of a chandelier with all the lights burning is very much better than with only one light. Small inverted burners can also be obtained, and are preferable to the upright where they can be used without disfiguring the looks of the fixture. In a good many cases the arms for the gas lights can be inverted, thus adapting them to the use of this new form of gas lamp. In any case the lamp can be used with a "goose-neck," and give the same results in illumination, the



THIS GIVES A HEAVY SHADOW UNDERNEATH, AND SWELLS THE LIGHTING BILL.

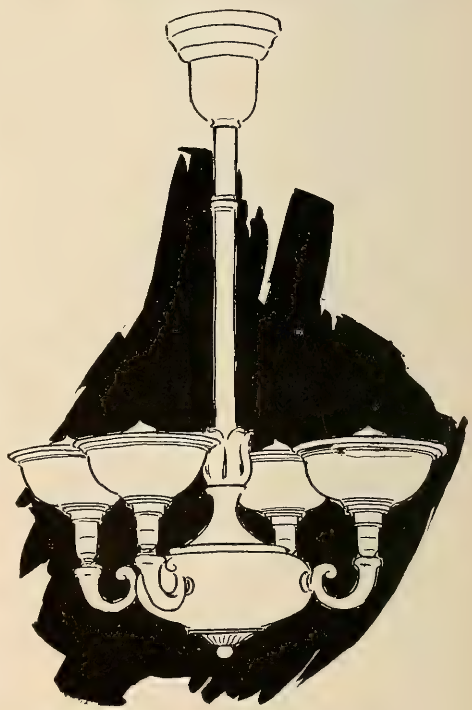
only objection being that this sometimes gives an awkward look to the chandelier.

In case it is impossible to invert the arms of the fixture, either gas or electric, recourse may be had to what is called "indirect lighting." In this method the light is all reflected to the ceiling, from which it is again reflected diffusely throughout the room. Reflectors made especially for this purpose can be had, which can be put on in place of the ordinary glass shades. This method of illumination has come into quite wide use, and is increasing in popularity. There is some loss by the two reflections, but in many cases this is not as great as that produced by the decorative glassware used; and by substituting Mazda or tungsten electric lamps for the old style, and Welsbach burners for flames, the saving effected will much more than offset these losses. A room lighted in this way is filled with a soft, diffused light like daylight, which is very agreeable to the eyes. Since the light-source itself is entirely hidden, the first impression is always that the room is dimly lighted, but this impression soon disappears in using the light; in fact, the source of light will very soon be forgotten altogether, just as the source of daylight is forgotten unless it is dim or dazzling.

A compromise between direct and indirect lighting is also in use, which is called semi-indirect. This differs from the straight indirect light in using translucent reflectors instead of the opaque. Any good white glass or satin finish prismatic reflector will answer the purpose. While these do not reflect as much light to the ceiling as the opaque, silvered plated reflectors, they allow some light to pass through directly, so that the results will be about the same. Care should be taken to select reflectors dense enough to entirely conceal the form of the luminous surface, otherwise the results will not be satisfactory.

Tell Your Troubles to Your Lighting Company.

In order to insure the changes that have been suggested being made in the most



BY THE USE OF SPECIAL REFLECTORS AND MAZDA OR TUNGSTEN LAMPS, AN EXCELLENT "INDIRECT" FIXTURE IS PRODUCED.

practical and inexpensive manner, it will be well to ask your lighting companies, both the gas and electric if you are using both, to send an illuminating engineer or lighting expert to look at your fixture and give you advice. While they may not be able to actually do the work, they will give you reliable information, having no interest in the manufacture or sale of fixtures. Most lighting companies have experienced specialists in this line, whose services they gladly place at the disposal of their patrons. It is a mistake to suppose that the lighting company seeks to needlessly load up your bill. While they naturally seek to sell as much of their product as possible, it is business policy for them to have their customers satisfied. A complaining and dissatisfied customer is both an aggravation, and an obstacle to the profitable conduct of their business.

All progressive lighting companies make it their first aim to reduce complaints to the minimum, and to satisfy their customers to the utmost. There may be some exceptions to this rule; but if you are inclined to consider your company one of the exceptions, do not be satisfied until you have brought the matter to the " man higher up." It is very rare, indeed, that a courteous and straightforward presentation of your case to the proper official of the company will not be met in the spirit of cooperation, and a genuine desire to assist.

Lighting a Fashionable Women's Apparel Store

An Ingenious Installation of Modern Arc Lamps

It is a truism to say that the artificial lighting of a store is to-day one of the most important problems with which the merchant has to deal. While this holds with every class of store, it applies with particular force to the store handling high class dry goods, and catering to an especially discriminating and wealthy patronage.

Of this class is the new store of Bonwit, Teller & Co., at Fifth avenue and Thirty-eighth street, New York. The store occupies the first four floors of a fine new building erected for the purpose, and was opened last October. The location is in the choicest shopping district in the city, being located in the heart of what was a few years ago the exclusive residential section, known as Murray Hill. In fact, business has not yet taken full possession of the neighborhood, the city residence of Mr. J. Pierpont Morgan being but a couple of blocks away; and what is of more interest to the illuminating engineering fraternity, the store is almost under the windows of the offices of The Illuminating Engineer. Needless to say, any store in such a location must make quality, elegance and fashion the guiding principles of its conduct.

The problem of artificially lighting such a store acquires unusual importance for several reasons. In the first place, the bulk of the year's trade is done by artificial light; this is due to the fact that the majority of customers to whom such a store caters are out of town during a good part of the summer, and hence confine their purchases to the darker months of the year; that they likewise do their shopping mostly in the later part of the afternoon during the darkest part of the day; and that in modern store construction the windows are largely enclosed for purposes of show window display, thus materially reducing the daylight.

In the second place, it is a matter of vital importance not only that the goods be illuminated so as to show to the best possible advantage, but that the illumination be such as to show the customers themselves in a favorable light. And, lastly, the treatment of the light units and their arrangement must be such as to produce a distinctly artistic and pleasing effect.

Among the several light-sources available for interior illumination an improved form of carbon arc, known as the " intensified arc," was chosen as the principal illuminant in this case. The reason for the choice of this lamp is its well-known

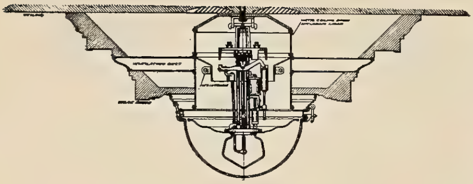


FIG. 1.—ARRANGEMENT OF RECESSED CEILING UNIT.

property of producing a light most nearly approaching daylight in its color value of any practical light-source at the present time. Furthermore, the lamp is capable of artistic treatment when properly handled, and possesses a high degree of efficiency as a light-source. The suspension at frequent and regular intervals and at uniform height of light units throughout large interiors is not only commonplace, but presents a bewildering array of light points, which distract attention from the goods illuminated, besides contributing to visual discomfort. In order to avoid these objections the plan was conceived of recessing the ceiling and designing a special fixture so that the light-source would not be suspended. The details of this arrangement are shown in Fig. 1. The majority of lamps are thus placed, as shown in the plan, Fig. 4. This raises the light-sources well out of the line of vision, and avoids the cluttered appearance produced by a large number of pendant chains or supports.

To avoid monotony, however, a few lamps in specially designed ornamental cases are suspended by chains at intervening points, as indicated also in Fig. 4. This has the further advantage of permitting a portion of the lamps to be turned on when required without giving the awkward effect always produced when a part of the units in a series are burning and a part extinguished.

The suspended lamp is shown in Fig. 2.

The selection of the glassware for the lamps was an especially important matter in this case. It was necessary that the glare be entirely subdued—*i.e.,* the form of the radiant be entirely hidden, the color of the rays unimpaired, and the best possible artistic effect produced. These several requirements have been met with great success by the use of a leaded glass globe made up of what is technically known as "granite glass," which is a translucent glass of varying density and slightly varying in shade, which, when lighted, has almost the exact appearance of polished shell, which is generally admitted to be the most exquisitely and delicately beautiful of any transmitting medium. To still further increase the diffusion opalescent inner globes are used.

FIG. 2.—ORNAMENTAL DESIGNS OF ARC LAMP CASES USED ON SUSPENDED UNITS.

FIG. 3.—A VIEW OF ONE OF THE UPPER FLOORS, SHOWING EFFECTS OF ILLUMINATION BY THE NEW INTENSIFIED ARC LAMPS.

The ceiling of the first floor is 19 ft. high; the ceiling lamps are 17½ ft. from the floor, and the hanging lamps 11 ft. The lighting of the second floor, which has a lower ceiling, is entirely by suspended lamps. In the French room, where evening gowns are displayed, Mazda lamps in crystal chandeliers and side brackets furnish the illumination, as in this case it is necessary to show the goods by a light of the same quality as that under which they will be worn.

The show windows are lighted with aluminized steel reflectors and Mazda lamps set alternately at 30 degrees and 15 degrees.

The scheme of illumination as worked out and described has proven eminently satisfactory to the proprietors, the sales people and the patrons.

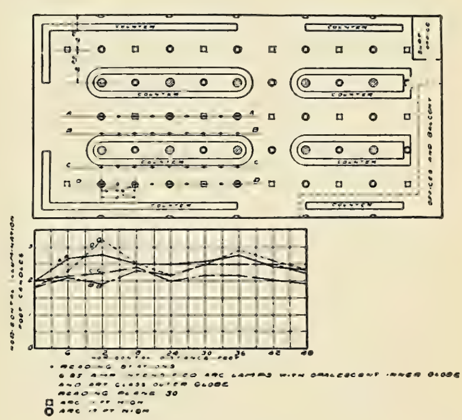


FIG. 4.—FLOOR PLAN, SHOWING TYPICAL FLOOR ARRANGEMENT OF UNITS; ALSO LOCATION OF TEST STATIONS.

Decorative Gas Lighting in Scranton, Pa.

By E. M. Stack

There seems to be an opinion abroad that the only hope of gas for use in modern decorative public lighting rests in the inverted mantle burner, and that the four or five years' start which the gas interests have allowed the electric light to get in the race for this business has been due to lack of confidence by the gas companies in the practicability of the inverted lamp as applied to American conditions. That there is no sound basis for such an assumption is plainly shown by two facts: first, that the original installation of decorative electric lighting of the type that has since come into such wide popularity used lamp-posts bearing electric lamps in an upright position enclosed in diffusing globes; and electric lamps used in this position are probably as frequently met with as pendant lamps in existing installations; second, the upright mantle gas burner has been in successful use for street lighting in this country to a very large extent for the past twenty years, and all that is necessary to adapt it to the so-called decorative systems is to use several of these burners, properly enclosed in diffusing globes, upon an ornamental standard. As simple and obvious as this method of decorative lighting appears it has only recently been put into practical use, the first installation being put in around the Court House Square in Scranton, Pa. In this case handsome standards of classical design bearing five single mantle upright burners, enclosed in opal globes, constituted the lighting units. Each burner is equipped with a pilot flame,, and the gas is turned on or off in the base of the standard, the valve being reached through a small door in the post. Each standard consumes 18 cu. ft. of gas per hour, which at the regular rate in

FIG. I.—THE NEW ORNAMENTAL GAS LAMP STANDARDS, COURT HOUSE SQUARE, SCRANTON, PA.

FIG. 2.—NIGHT VIEW OF NEW GAS ILLUMINATION, COURT HOUSE SQUARE, SCRANTON, PA.

this city costs a little less than two cents. There are two hundred and sixty posts in the installation.

A daylight view, showing the general appearance of the installation, is given in Fig. 1, and a night view of another section of the square is shown in Fig. 2.

The notable thing in all these gas installations is the remarkable uniformity and daylight appearance of the illumination produced.

The Scranton Gas & Water Company reports that the demand for similar installations from merchants and business men is so great as to tax their facilities for installation.

While the inverted mantle lamp undoubtedly has its own peculiar advantages, perhaps the greatest is the fact that gas lighting can now supply lamps for either the upright or pendant position that operate with entire success and with nearly equal efficiency, thus enabling them to meet all conditions and tastes.

Improved Street Lighting in the District of Columbia

By Walter C. Allen

The improved form of street lighting installed in one of the prominent avenues of the District of Columbia, as described in *The Illuminating Engineer* for October, 1910, has been considerably extended in that city during the past summer. In two of its principal features the newer installation differs somewhat from that described in the above mentioned article. The new posts are of a simpler and more dignified design and the lamps themselves are of a somewhat higher candle-power. One hundred candle-power (125 watt) 5.5 ampere series tungsten lamps have been used throughout the seven and one-half miles of streets covered by the new installations, one lamp to each post. Two heights of post are used; one 12 ft. from the ground to the center of the globe (see Fig. 1), placed around the prominent Government buildings and the public parks; the other 10 ft. 3 in. to the center of the globe (see Fig. 2), placed in all other localities. Along the front of the White House (see Fig. 3), the State, Ward and Navy building, and the Treasury building, a distance of 1,700 ft., as well as on the east and most prominent side of the latter building, the posts have been arranged in pairs, opposite each other, with a spacing, measured along the axis of the street, of 70 ft. on the average. Special treatment was also given to the arrangement of the posts in front of the

FIG. 1.—CAST IRON LAMP-POST, WITH GLASS STREET SIGN. HEIGHT, 12 FT. TO CENTER OF GLOBE.

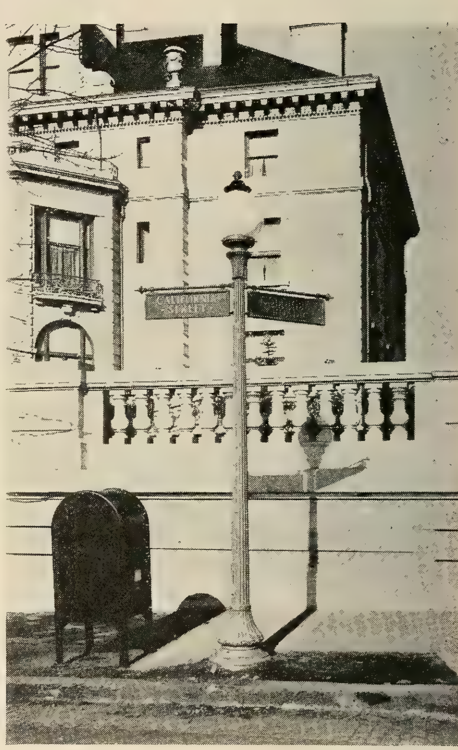


FIG. 2.—CAST IRON LAMP-POST, WITH CAST IRON STREET SIGN.

FIG. 3.—VIEW OF PENNSYLVANIA AVENUE. SIDEWALK IN FRONT OF THE WHITE HOUSE.

Washington Public Library building, and around Dupont Circle, and Farragut, Lafayette and McPherson squares. In these instances the taller of the two posts was placed on the park side of the street, while on the opposite side the shorter post was used, thereby giving prominence to the public park. In all other localities the usual spacing of 60 ft., measured along the axis of the street, was followed, with the posts "staggered" on the two sides of the street.

The seven hundred and ten lamps included in this installation are divided among eight circuits operated from constant current transformers connected with the three-phase, twenty-five cycle, sixty-six hundred volt primary feeders of the Potomac Electric Power Company. The lamps on the one side of the street are on a different circuit from those on the other, so as to reduce to a minimum the possibility of circuit troubles causing an entire street to be left in darkness. Instead of the heavily armored, two-conductor cable used in the first installation of lamps on this system, as described in the above mentioned article, single conductor cables of No. 10 B. & S. gauge, with 9-32 in. varnished cambric insulation and 1/8 in. lead sheath, were laid under the sidewalk with only a strip of 7/8 x 4 in. pine immediately above them for protection. (See Fig. 4.)

The cast-iron posts, including the globes, street signs and the ornamental tops, were purchased by the District of Columbia, but were equipped with lamps, sockets and fittings and erected by the Potomac Electric Power Company at the latter's expense. After erection the posts were painted at the expense of the municipality with a fine russet bronze powder, with a finishing coat of light green, wiped off while still wet, giving the effect of new bronze metal. All the cast parts of the posts were made from aluminum patterns belonging to the District of Columbia.

Although all the items relating to the

FIG. 4.—CONSTRUCTION DETAIL. METHOD OF LAYING CABLE.

cost of installation are not yet at hand, a very close approximation has been made by the lighting company, who place the figure at forty-five dollars per post, which includes the cost of cables from the sub-station to the lamps, all conduit work, laying of cables, erection of posts, replacing pavements, furnishing lamps, sockets, fittings, etc. The cost of the posts and globes and the painting is not included. The following figures may also be of interest:

Shorter post, with 14-in. globe and top, each	$19.11
Taller post, with 16-in. globe and top, each	21.66
Copper frame and wrought iron brackets, with four glass signs, each	4.72
Cast iron sign plates, with raised letters, each	2.70
Cost of maintenance, per lamp, per annum paid by municipality	25.85
Cost of painting, per post, estimated	.60

On one of the avenues traversed by an electric street railway these 100 c.-p. incandescent lamps replaced a circuit of 6.6 amperes direct current series inclosed arc lamps, the latter being suspended 17 ft. above the roadway on 9-ft. mast arms, the posts having an average spacing of 200 ft. Inquiries were made among the older motormen on the line for their opinions con-

FIG. 5.—NIGHT VIEW OF ILLUMINATION ON SIXTEENTH STREET.

cerning the new lights. Four men out of forty-two stated that the lights were too dim and too low down and hurt their eyes. The other thirty-eight men reported that the new system was far superior to the old. The following is the railway inspector's comment in transmitting those opinions:

"The men think the new lights far better than the old arcs, because they give more light and are not so bright and blinding; in other words, the lights are softer to the eyes and make them more able to see traffic. They say that the arc lights, being so bright while passing them, have a tendency to a blinding effect after leaving the light, while the new lights, being placed closer together and near cross streets, make a big improvement, two to one, over the old arcs."

No night views have yet been taken of the new installation; the photograph in Fig. 5 shows a portion of Sixteenth street where 80-c.-p. (100 watts) lamps are used. (See *Illuminating Engineer,* October, 1910.)

A Problem in Church Lighting

By R. F. Pierce

Church lighting presents some of the most difficult problems which the practising illuminating engineer encounters. The character of the interior is usually such that the walls and ceiling may not be utilized for purposes of reflection. More often than not the architectural fixtures preclude the placing of light sources in the most advantageous positions for securing the best illumination, unless artistic considerations are entirely disregarded. The effects of glare are particularly aggravated by reason of the fact that the eyes of members of the congregation are directed in one direction for a considerable length of time, and eye fatigue from excessive glare and exposed light sources of high specific intensity is unusually noticeable.

Churches are quite generally lacking in ventilation, and the organic matter exhaled from the lungs of the occupants soon produce a stupefying effect which fully accounts for the soporific effects attributed to sermons by the professional humorist. It is thus highly desirable that light sources be used which tend to improve the rapidity of air circulation and consume organic matter. For this purpose, the incandescent gas lamp is plainly especially desirable, but lamps of this character require placing in easily accessible positions so as to minimize maintenance labor, and this is frequently difficult to accomplish without conflicting with other equally important requirements.

FIG. 1.—VIEW OF CHURCH, LOOKING TOWARD THE ALTAR.

Very often, however, the engineer is able to pick out features in the construction, which from the view point of the inexperienced, may appear unfavorable, and utilize them for the accomplishment of the very purpose which they seem to antagonize.

The Grace Episcopal Church, Fifth and Linden streets, Allentown, Pa., is an example of church architecture of frequent

occurrence. The plain interior with exposed roof trusses plainly precluded the use of fixtures of any sort. To harmonize with the interior, it was necessary for the light-sources to be as unobtrusive as possible. The presence of the open roof trusses presented the principal obstacle in the way of using any of the conventional lighting fixtures, and in this case the engineer, Mr. James W. Brown, of the Allentown Gas Company, utilized the lower chord of the roof trusses for supporting the lamps and pipe lines, and also for screening the light-sources from the eyes of persons in the pews. The accompanying illustrations show not only the arrangement of the lamps and the effect of the illumination produced, but also the ingenious manner in which convenient control was obtained. Figs. 1 and 2 show the effects of the illumination looking toward and from the altar respectively. It is unnecessary to comment upon the superiority of this illumination over that generally obtained in buildings of this character. Fig. 3 shows the arrangement of lamps and piping. The main gas supply line was run along the upper sill on the one side of the build-

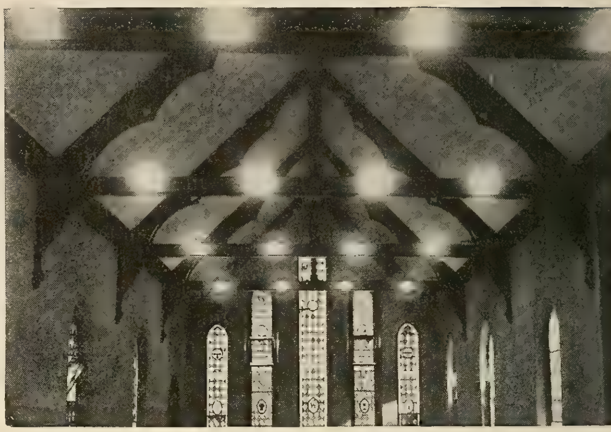


FIG. 2.—VIEW FROM THE ALTAR.

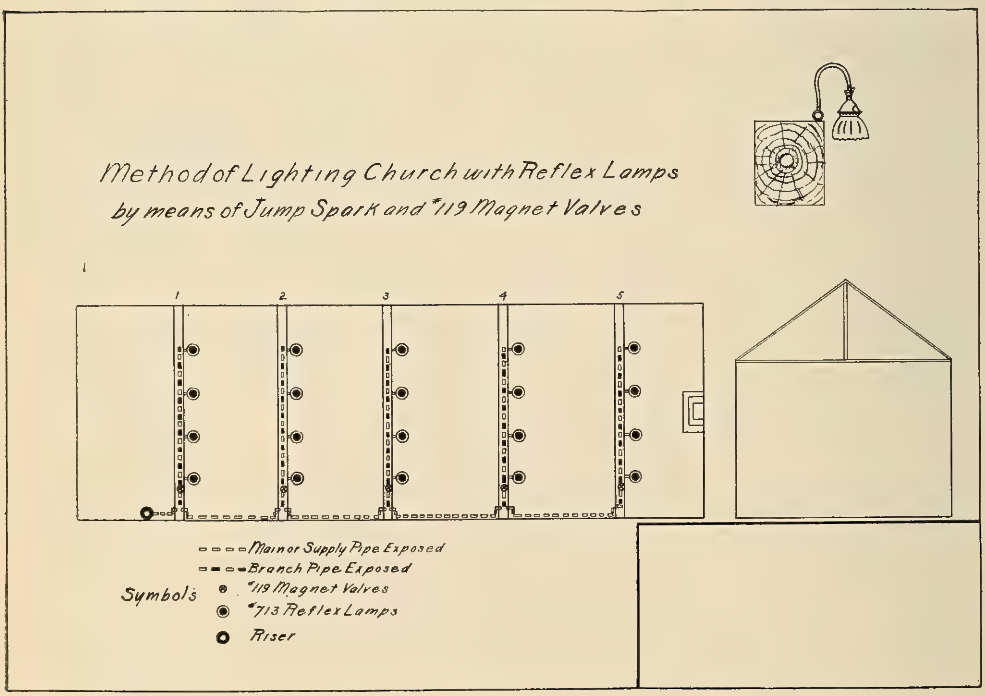


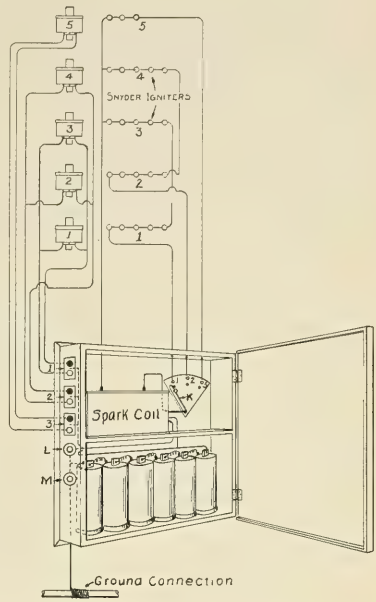
FIG. 3.—PLAN SHOWING ARRANGEMENT OF LAMPS.

ing with branch lines extending along the top of each of the five chords extending across the building. Four of these branch lines were fitted with four outlets for Reflex lamps and Alba reflectors, while the fifth chord was provided with three outlets and equipped with Reflex lamps and angle shades to direct the light toward the altar. Each branch line was provided with a separate magnet valve to enable its control from a distance.

The wiring connections are shown in Fig. 4. The magnet valves controlling the lamps on chords 1 and 3 were operated from one push button (series No. 1); those on chords 2 and 4 on another push button (series No. 2); and the 5th chord on a separate button (series No. 3). The jump spark system was used for lighting the lamps and was also connected in three circuits with a common return wire to the spark coil as shown in Fig. 3

The method of procedure in lighting lamps on series No. 1 is as follows: Press push button M and the white button of switch No. 1 at the same time, turning on the gas. With switch K on point No. 1, press push button L to light lamps. To light lamps in series No. 2, the same procedure is followed, using white button of switch No. 2 and placing switch K on point No. 2. The lamps of any series are turned off by pressing the corresponding black button in conjunction with push button M.

This system leaves nothing to be desired in the way of convenience, simplicity, or reliability, and the illumination is exceptionally pleasing and comfortable.



Wiring Diagram Showing Method of Operating Jump Spark & #119 Magnet Valves for Lighting Reflex Lamps from One Cabinet

FIG. 4.

The continuous passage of the air through the burners removes vitiating matter and the rapid air circulation keeps the temperature within comfortable limits. In fact, every hygienic and artistic requirement is met in a most satisfactory manner, and the ease of control was a great surprise to those who were unfamiliar with modern gas lighting appliances and fancied that the use of gas involved inconvenience and annoyance.

Nature as a Guide to Art in Lighting

How the Lighting of Landscapes Points the Way to Correct Interior Illumination

Pictorial art is largely a matter of light and shade. This applies to the term as used in its broadest sense, which includes all art that is appreciated through the sense of vision; thus plastic and sculptural art and architecture fall within its meaning. That variation in the intensity of illumination, which is the scientific definition of light and shade, is the essential element in pictorial art will be readily appreciated by considering how completely we understand the meaning of a picture in black and white, or a statue or building in which color forms no part; and also by observing how little color alone appeals to us. The rainbow, which is the highest example in nature of color separated from all effect of light and shade, produces but a comparatively feeble effect of beauty; a moonlit landscape of the simplest kind, in which there is a minimum of color, produces a far deeper esthetic effect.

Man has developed under the constant influence of natural light, and both his physiological sense of vision and the appreciation of beauty through these organs is the outcome of his environment. While art is not merely imitative of nature, it is essentially so; or, putting it in another way, art can never contradict nature; it is imitation which suggests to the mind more than it literally depicts. The highest function of art is to appeal definitely to the imagination; but imagination is only a structure built of remembered experiences, and hence is founded upon reality, which is nature. If we are to use artificial light from the artist's viewpoint then, we must imitate the lighting effects produced by the natural luminaries.

Let us begin with the simplest and most obvious observations. First among these is the fact that natural light is almost entirely from above, and is brightest when it comes from most nearly the zenith. So far as our experience unaided by science goes, we live upon a circular plane covered with a huge dome. For thousands of years, until science had shown us the real nature of the universe, this apparent condition was believed to be the real one. This surrounding dome we call the sky. We may observe then that under all conditions the sky is the brightest part of our field of vision in nature, which we call in general terms the landscape.

The Lesson of the Sky.

In interior lighting the roof, or ceiling, is the counterpart of the sky. We may then introduce the first principle in interior lighting, viz., the roof or ceiling should be the lightest surface or part of the inclosure. By studying the effect of the sky upon the general landscape we can draw safe conclusions as to the part which ceiling lighting and decoration plays in interior illumination. The sky undergoes every variation, from perfect clearness, with dazzling sunshine, to complete blackness and obscurity on a cloudy, moonless night.

Blue sky, and sunshine either direct or through light clouds, produce cheerfulness, while a sky heavily overcased with clouds produces an effect of gloom and depression. So powerful is the influence of sunshine in introducing cheerfulness and buoyancy of feeling that it is next to impossible for the mind to be otherwise than in a cheerful state when the eyes are beholding a sunlit landscape. This fact is well expressed in the familiar lines of "Thanatopsis":

"When thoughts
Of the last bitter hour come like a blight
Over thy spirit, and sad images
Of the stern agony, and shroud, and pall,
And breathless darkness, and the narrow house,
Make thee to shudder, and grow sick at heart;
Go forth, under the open sky."

The lesson from this is that if we would have an interior cheerful and enlivening the ceiling at least must be light, both in color and in illumination. No matter how well it may be lighted, a dark colored

ceiling is never distinctly cheerful in its effect.

Sunshine on a perfectly clear day, especially with the sun near the zenith, shining upon light surroundings, gives an effect of heat and may suggest discomfort. This is the effect shown in many of the paintings of Remington depicting scenes on our own arid Western planes, and still more vividly in some of the paintings by Veretschagin of scenes in India. Under these conditions the shadows are very short, sharply defined, and black, producing what the artist calls a "hard" picture. The plain inference from this is to avoid a single dazzling light-source placed in the center of the ceiling as a means of lighting a room.

Shadows Denote Repose.

Long shadows occur in the early morning and late afternoon. Generally speaking, we are less familiar with the early morning hours than with the afternoon and evening. Long shadows, therefore, always suggest repose. This is beautifully expressed in the words of the Hebrew prophet:

> "And a man shall be as a hiding-place from the wind, and a convert from the tempest, as streams of water in a dry place, *as the shadow of a great rock in a weary land.*"

The feeling of rest and peace that come with the waning day is likewise charmingly expressed in "The Lotus Eaters":

> "In the afternoon they came unto a land
> *In which it seemed always afternoon.*
> All round the coast the languid air did swoon,
> Breathing like one that had a weary dream.
> * * *
> A land where all things always seemed the same."

As the shadows lengthen with the declining sun they also lose their sharpness, even in a clear day; it is seldom that there are not some faint clouds or haze in the late afternoon which further softens their outlines. It is under these conditions that the landscape has its most perfect combination of peace and cheerfulness. This is taken advantage of by the amateur photographer having an eye to art, who selects it as the most propitious time for landscape photography. A view which may be quite commonplace and uninteresting at high noon becomes a work of art when photographed by the soft, mellow light, with its long shadows, that comes an hour or two before dusk. Here again the lesson is plain: each light-source must be subdued in brilliancy, and of so large an area as to produce soft shadows, i. e., shadows without sharp outlines, and be of a warm color, yellow well tinged with red being the most exact reproduction of nature's model. It is impossible to reproduce the condition of long shadows in interior lighting, but the other conditions can be fulfilled with a high degree of fidelity.

Light Signifies a Void.

While the ancients represented the sky as being supported in some of their mythology, it does not have this appearance to the eye. Though the clear blue of a cloudless sky may be readily conceived as a hemisphere, or dome, it does not produce the feeling of a material covering; and clouds are distinctly without support. "The earth below and the heavens above" accurately expresses our natural conception of the universe. From this the psychological fact follows that light represents empty space, or unsupported matter. This law has a large and vital application in the relation of artificial light to interior architecture. The principle may be stated as follows: those strucural features, or parts, which actually or ostensibly serve as supports must be kept in comparative shadow. Thus a column, pilaster, or capital must not be more brilliantly illuminated than the intervening wall space, or the ceiling or roof. Likewise the panel trusses and stiles in the ceiling must not be more brilliantly lighted than the panels. The transgression of this principle is one of the most frequent faults in architectural lighting. Mechanically, the most natural place to attach a light-unit is to a projection; hence the use of the supporting parts mentioned as locations for more or less closely attached light-sources is one of the most common occurrences.

The law stated, however, is inexorable, and applies to color as well as to illumination. A conspicuous example of this may be found in the new Public Li-

brary in New York; there is one room having an extravagantly and elaborately carved oak ceiling of a dark brown tint, supported upon walls of white marble. The effect is almost uncanny, producing the feeling of being under an enormous unsupported weight; and there are several other similar cases in the building.

Though it does not pertain strictly to illumination, another provision of the laws of nature may be mentioned here, and that is the decoration of flat ceilings with elaborate paintings or carvings. The sky never contains sharp lines or fine detail, and is most beautiful when covered with the irregular and untraceable variations of light and shade formed by light clouds. Nature has especially protected the human eye from light from above. The natural field of vision does not extend much above the horizon, and in every normal case of accurate vision the eye looks down. To place something requiring visual acuity directly above the head is so gross and obvious a contradiction of nature that it is hard to understand why such a sin should ever be committed, especially by those who boast as arbiters of art.

Overcast Skies and Dark Ceilings Gloomy.

We have deduced a number of important conclusions from a consideration of sunlight, either unobscured or modified only by light clouds. What of the overcast sky, and the still darker storm cloud, which is equally familiar if not so frequently met with?

The uniformly clouded, or "leaden" sky, which destroys all distinct shadows, is in its milder forms merely negative in its effect, and in the more pronounced cases oppressive and dispiriting. It arouses no feelings that can in any way arouse or inspire action. It is the emblem of hopelessness. Fortunately, it has no counterpart in artificial illumination; for even though the general illumination be dim, it is relieved by the light-sources themselves which afford points of cheer and hope.

The storm cloud, however, with its exaggeration of darkness is awe-inspiring; and this feeling is raised to its highest pitch when darkness is broken by vivid lighting flashes. It is emblematical of the deepest feelings and most moving passions, and is therefore a favorite setting of the novelist and playwright for his most dramatic and tragic scenes. The effect has been used to a certain extent in churches and temples for the same general purpose. This practice was more common in times past when fear was an important element in religious instruction and worship. As this element has been subdued, the churches have been more brilliantly lighted. One could make a fairly safe estimate of the relative parts played by hope and fear in any religion or sect by observing the lighting of their places of worship. The cheerful philosophy of the present has little occasion to use the heavy masses of shadow and dark ceilings which suggest the irresistible and unpitying power of the storm cloud.

Moonlight.

So much for the light of day: what, then, of the night? Since the cloudy night is practically without light, we have only to consider the case of clear moonlight, at least so far as any inference applicable to artificial lighting may be drawn. Moonlight possesses two distinct qualities: the shadows are masses of impenetrable blackness, and the high lights are of a cold blue-green color. The feeling produced by moonlight may in general be expressed by one word, mystery. The psychological reason for this probably lies in the fact that nothing is clearly defined, at least as compared with daylight. We see forms in silhouette, and must fill out the details from our imagination. Poets and dramatists, therefore, choose moonlight as the appropriate setting for love scenes. Perhaps the most familiar is that in "The Merchant of Venice."

Lorenzo. The moon shines bright. In such a night as this,
When the sweet wind did gently kiss the trees
And they did make no noise—in such a night,
Troilus methinks mounted the Trojan walls,
And sigh'd his soul toward the Grecian tents,
Where Cressid lay that night.

Jessica. In such a night,
Did Thisbe fearfully o'ertrip the dew,
And saw the lion's shadow ere himself,
And ran dismay'd away.

Lorenzo. In such a night,
Stood Dido with a willow in her hand
Upon the wild sea-banks, and waft her love
To come again to Carthage.

Jessica. In such a night,
Medea gather'd the enchanted herbs
That did renew old Æson.

Lorenzo. In such a night,
Did Jessica steal from the wealthy Jew,
And with an unthrift love did run from Venice
As far as Belmont.

Jessica. In such a night,
Did young Lorenzo swear he lov'd her well,
Stealing her soul with many vows of faith,
And ne'er a true one.

Lorenzo. In such a night,
Did pretty Jessica, like a little shrew,
Slander her love, and he forgave it her.

More recently the author of "The Harvest Moon," after setting forth the principles of the psychology of color, adroitly leaves the lovers in the moonlight and retires, similingly confident of a happy *denouement*.

What is the application of this phenomenon to artificial lighting? To the worldly matron, blessed with a number of marriageable daughters, it may suggest possibilities for lighting the parlor that she never before dreamed of. To come down to a prosaic quotation from that most practical of modern philosophers, "Old Gorgan Graham," the self-made merchant:

"Marriages may be made in heaven, but most engagements are made in the back parlor, with the gas so low that a fellow doesn't really get a square look at what he's taking."

But merely turning down the gas is not a sufficiently close following of nature's example; the color of the light also has an important psychological effect. Science has arisen to the occasion even in this delicate case; the mercury vapor lamp gives out a light which is visually the exact counterpart of moonlight in color, if sufficiently subdued. It was very successfully used for this purpose in the lighting of the "orangerie," one of the popular dining rooms in the Hotel Astor, New York. As to what extent this accounts for the remarkable popularity of this restaurant, especially with the theater-going young people, it would perhaps be rash to venture an opinion. There is no doubt, however, that the lighting was most effective and beautiful, and has served as a model for many more or less faithful imitations since.

We have pointed out but a few of the more obvious lessons to be learned from a study of nature's lighting, but enough has been set forth to show how valuable a field of study "the earth below and the heavens above" afford for the illuminating engineer. Verily, "there is nothing new under the sun."

Lighting a Laundry

By J. M. Coles.

While all industrial lighting has certain common necessities, there are always some special features for each particular branch. To paraphrase the old saying: "There are tricks of lighting in all trades." In the particular industry under consideration the surfaces which the eye encounters are white or light colored—generally the former. While the field of sharp vision—*i.e.*, the space within which it is necessary to see distinctly—is comparatively large, these two conditions "indicate"—as the doctors would say in prescribing—a uniform illumination of moderate intensity—*i.e.*, about the intensity of average interior daylight. A fact may be stated here, which is contrary to the ordinary conception of the relation between daylight and artificial light; in modern lighting where careful eye work is required, the artificial light provided is generally much brighter than the average daylight furnished.

The problem of lighting a laundry so as to meet these conditions satisfactorily may be successfully solved by the use of modern high-power gas lamps, commercially known as "gas arcs." Two views in the Stancourt Laundry, New York, a laundry thus lighted, are shown herewith, the cuts being made from photographs

FIG. 1.—NIGHT VIEW, GAS ARC LIGHTING, STANCOURT LAUNDRY, NEW YORK.

FIG. 2.—ANOTHER VIEW OF SAME FLOOR; NOTE EXCEPTIONAL DETAIL.

taken entirely by artificial light, as is proven by the fact that the windows are dark.

The lamp used is a recent pattern of the inverted mantle type, and is equipped with a clear globe and a segmented silvered glass reflector. The quality of the illumnation is well brought out in the photographs. Its uniformity may be observed by noting the lighting of the floor in Fig. 1, while the absence of sharp shadows and the daylight effect in bringing out all of the detail, even of white garments, is equally evident. As a matter of actual fact, the general lighting of the room is doubtless better under the gas lamps than by daylight. While the light is naturally good close to the windows, it falls off in intensity very rapidly toward the center of the room, and in this location the artificial light is better.

The details of the installation are as follows: Size of room, 75 x 100 ft., with 12-ft. ceiling; number of lamps used, 19, or 14 to a floor, according to conditions; kind of lamp, three-mantle Humphrey inverted arc; gas consumption, 12.28 cu. ft. per hour, at 3.5 ins. pressure; total amount of light per lamp, 296 mean spherical candlepower, or 3720 lumens.

Lighting Securities

Possible Effect of Recent Inventions on Their Future Values

In the *Saturday Evening Post* of October 28 Mr. Roger W. Babson has an article on the above subject, to which he has given the sub-title, "Struggles Between Gas and Electric Companies." From the strictly financial standpoint Mr. Babson's views are undoubtedly sound, and his discussion and analysis of the subject accurate and instructive. On the scientific side of the problem, however, his conclusions, and especially his prophesies, are not so well taken. He opens his article with the following observation:

"Few people, except those in the innermost councils of certain gas and electric lighting companies, realize the great revolutionary possibilities in the so-called fireless cookers, different makes of which are being advertised in the leading magazines to-day. Though little has been written or heard of the underlying principles involved, probably few inventions since the electric motor have the possibilities of so radically changing household methods as has the invention of the fireless cooker."

After remarking on the enormous waste of heat that takes place in the production of power, the writer says:

"'Now, what has this to do with lighting securities?' the reader asks; and briefly the answer is as follows: The ultimate value of 'lighting' securities, whether the lighting is by gas or electricity, rests not in the use of gas or electricity for lighting purposes, but rather in its use for heating and cooking purposes. The people to-day have all the light necessary; and, though the demand for light will increase to a certain extent with the population, yet it does not need to increase proportionately with the population, as two or three people in a room require no more light than one person; while a family of twelve in the poorer quarter of a city will use only a small fraction of the light used by a wealthy family of three in its city mansion. Therefore the future of gas and electric securities depends upon the use of gas and electricity for cooking and heating purposes rather than upon their original use, which was for lighting purposes.

"Up to the present time, gas companies and electric companies have been greatly handicapped in the sale of their product by the expense of manufacture. Though seldom realized, there is little or no expense connected with the 'manufacture' of coal, the principal item of expense being its extraction from the mine and the transportation charges. Even the cost of hauling it through the streets from the coal yard to the house and carrying the same into the cellar is often greater than that of the coal itself at the mine. Now all gas companies and such electric companies as do not use waterpower are obliged to purchase this coal, have it transmitted to their plants, and burn the same—even before obtaining the gas or electricity which they, in turn, will sell. Consequently it will be seen that, for purposes other than lighting, gas companies and electric companies are greatly handicapped; and no corporation can buy coal and use it for the generation of gas and electricity and then sell and distribute said product for a price that will enable a housewife to use it for her cooking as cheaply as if she herself purchased the coal and used it herself.

"As 'necessity is the mother of invention,' the gas companies, when forced out of the cream of the lighting business by the invasion of the electric lighting companies, succeeded in cheapening the cost of producing gas so that it could be used for cooking purposes. This use has greatly increased, so that to-day, instead of the greatest consumption of gas being on Christmas Eve, as was the case twenty-five years ago, it is now on the Fourth of July; in fact, if the gas companies had not been able to reduce the cost and increase the efficiency of that product so as to make it practicable for cooking purposes, there would have been reorganizations of a large percentage of our nation's gas companies since the invasion of the electric light. Instead, as the gas companies have been able to adapt their product to cooking uses, their output has continually increased and gas securities have a most enviable record for stability and strength; in fact, it is claimed that no other class of bonds shows such a small percentage of defalcations as gas securities.' The following, taken from the circular of a firm that makes a specialty of selling gas bonds, is doubtless true:

"'At the present time most families of average means use electricity for lighting purposes and gas for cooking purposes either all or a part of the year; and, so long as conditions remain *in statu quo,* the earnings of both gas and electric securities should gradually increase in a growing community, where the companies are properly managed.

"'If, however, any method should be discovered whereby either gas or electricity could be delivered to the housekeeper at very much cheaper rates, or whereby the housekeeper could concentrate all her heat, wasting none, then there is likely to be a revolution in lighting securities. As to whether the gas companies or the electric lighting companies will reap the greater harvest from such an invention, it is impossible now to anticipate; but certain new developments indicate that the electric lighting companies are almost sure to receive a distinct benefit.'"

The writer's statement that "the people to-day have all the light necessary" is an opinion only, and one with which we cannot agree. We believe that there is still not only the opportunity but the crying need for "more and better light." In the residences of the wealthy and the fairly well-to-do the need is probably rather for better than for more light; but in the dwellings of the poorer classes, and especially in the houses in the smaller towns and in the country, which will ultimately be reached by the gas and electric supply companies, there is still a wide opportunity for increase in the amount of light used.

Heat and Power the Larger Field for Expansion of the Use of Gas and Electricity.

Undoubtedly, however, the greater field of expansion for both the producers of electricity and gas is in supplying heat and power. As the writer points out, both gas and electric current may be considered finished products of coal, with the exception of such electric current as is generated by water power. The statement that it is impossible to sell gas or electricity at a price which will enable the housewife to use it for cooking as cheaply as coal is not unqualifiedly true. The reasonably careful use of gas in the most modern appliances will show a distinct economy over the use of coal, even leaving out the item of labor and convenience. This is due to the fact that the application of heat to the exact purpose required is made with so much less waste.

The use of electricity for the production of heat as compared with gas is handicapped by the enormous loss entailed in the conversion of heat into power. In the making of gas there is simply the separation of the original fuel into two separate elements, one gaseous and the other solid; and in the course of this separation several by-products are obtained which are entirely lost in the direct burning of the coal. In converting coal into electrical energy it is impossible, even with the best modern apparatus, to obtain more than 15 per cent. of the heat value in the shape of power delivered by the steam engine. This power must again be converted into electrical energy, entailing another loss, and the energy must be distributed to its destination, causing it to suffer a still further loss. If the consumer, therefore, received 10 per cent. of the heating value of the coal originally consumed, he would be doing exceedingly well; the average under present conditions would probably be nearer 8 per cent.

The competition of electricity with gas as a source of heat, therefore, has a very serious handicap, which there seems to be no immediate prospect of overcoming. The fireless cooker will undoubtedly come into very considerable use, and offers perhaps the most feasible opportunity for the application of electricity as a

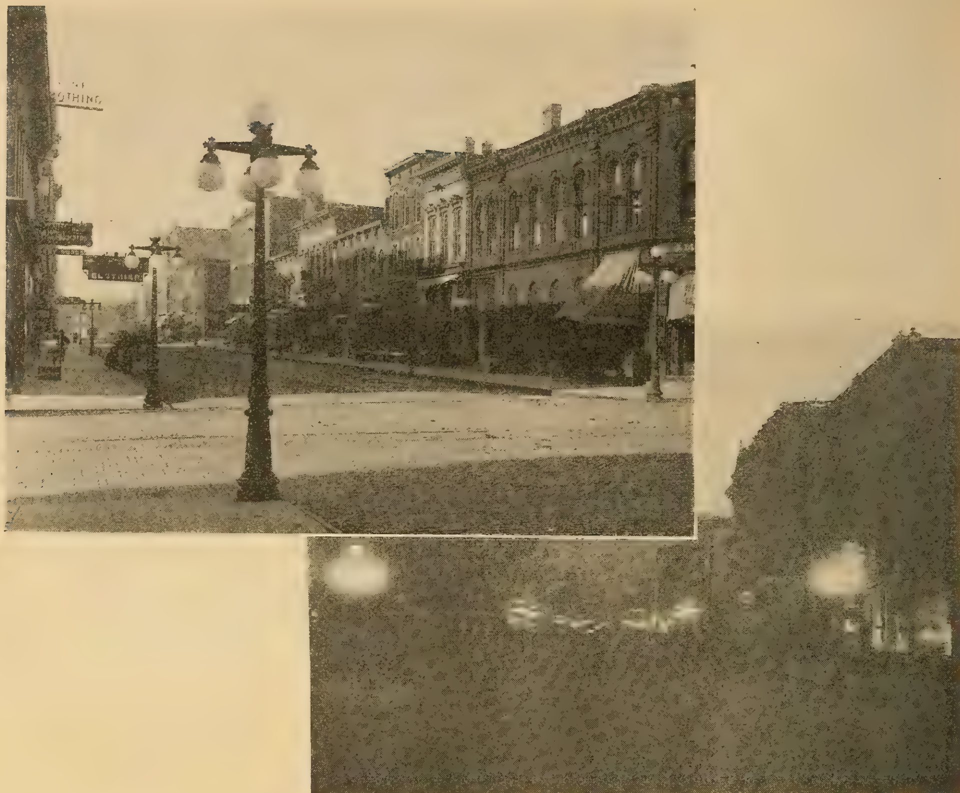
source of heat, but only for the reason that the total quantity of heat required in this apparatus is small, and hence the absolute difference in cost is not so large an item that it may not be charged off to whatever advantages of convenience and elegance the method may have. The fireless cooker depends upon the simplest possible principle, viz., the insulation of the cooking vessel so as to prevent the radiation and convection of heat into the air, and it requires no very great mathematical ingenuity to adapt this principle equally well to any practical source of heat, thus producing proportionate economy.

This economy of heat in the case of gas means just that much reduction in the amount of gas sold. The fireless cooker looms on the horizon of the gas company very much as the tungsten lamp did three years ago on the electric company's horizon, viz., as an invention whose benefit may be reaped entirely by the consumer. The gas companies may be cheered by the experience of the central stations, which have found that the tungsten lamp has been a means of increasing rather than decreasing their revenues when properly handled.

The field of expansion for the gas industry is as broad as that for the production of electric current; both are destined to continue their phenomenal progress for many years to come. The genuine interest throughout the country in "the City Beautiful" is unmistakable, the extent to which decorative street lighting has grown being a sufficient evidence of this in itself. The greatest blemish upon the American city to-day, and of all prosperous cities in the world for that matter, is the smoke nuisance. The cities east of the Allegheny Mountains, which are natural consumers of anthracite coal, suffer least, but even these are bad enough; and every American city west of the Allegheny Mountains lives in a cloud of smoke, from which there is a continual rain of soot which befouls the atmosphere and besmirches all things upon which it descends. This condition is unnecessary and remediable, and the solution of the problem is gas. Considering the fact that natural gas is piped from West Virginia to Cleveland and Buffalo, and other equally distant points, and that the by-products of the manufacture of artificial gas are in unlimited demand, there is no physical or commercial reason why most American cities should not be supplied with gas made at the coal mines. For each separate residence in the city to have its own little heating plant for the consumption of raw fuel, with its attendant labor, inconvenience, lack of economy, and dirt is a relic of primitive ages when a fire in the tent or cave sufficed for heating and cooking.

Gas is being sold in at least one city in this country comparatively far remote from coal mines at 47 cents per 1000 cu. ft. in large quantities. A gas for fuel purposes only could undoubtedly be made and distributed at a profit at this price, or less, and if the same care were taken in devising heating systems that has been used in gas ranges and cooking apparatus, it would unquestionably supplant coal for heating as largely as it has supplanted it for cooking. The smokeless city is entirely possible; it is simply a matter of changing the city of coal to the city of gas.

Unless some method is discovered of producing electricity without the enormously wasteful process through the intermediate conversion of the fuel into heat it cannot hope to make any large inroads into the gas industry in this respect; it will take something very much more revolutionary than the fireless cooker to bring about any perceptible difference in the field of gas and electric supply. The use of electricity for the distribution of power, and its extension into fields not at present reached, will provide for all the expansion that can be taken care of without causing booms, with their disastrous speculation and reactions. However, it behooves the gas interests to watch their preserves in the heating field, and not allow the choicest game to be gathered in by the electric interests as they have in electric lighting. The electrical people are alert and after the game, and it will require more than a mere "No Trespassing" sign to keep them out.



DAY AND NIGHT VIEW OF THE NEW ORNAMENTAL STREET LIGHTING AT FREEPORT, ILL.

Decorative Street Lighting in Freeport, Ill.

Freeport is a thriving city of the Middle West, with a population of about 18,000. That it is both thrifty and progressive is proven by the handsome installation of decorative street lighting which it now possesses. Night and days views of one of the lighted sections are shown in the above illustration, which shows the character of the lamp-posts used. These are what may now fairly be called a standard type, consisting of a handsome standard supporting four pendant lamps and one upright, all equipped with large diffusing globes. The lamps are 60-watt tungsten, the four on the arms being run from dusk until 11 o'clock, and the central lamp until daybreak.

The installation was originally worked up by the merchants and business men who paid the first cost of posts and connection. The city furnishes the lamps and the electric current.

Those who have contributed financially to the success of this lighting system are more than pleased with their investment. Besides creating a spirit of civic pride among the citizens, which is the basis of all municipal improvements and progress, it repays in actual dollars and cents by keeping trade at home, and by giving the city that air of attractiveness and prosperity which makes it an inducement for others to seek it as a home and a place of business.

The small city has somewhat the same desire to be classed with larger towns that the small boy has to become a man; and there is nothing which so contributes to giving the metropolitan air to a town as a "Great White Way."

Artificial Illumination of a Modern Machine Tool Works

Artificial Light Now Equals Best Daylight Illumination for Some Purposes

By Geo. W. Walker.

A machine tool serves two purposes: it produces various mechanical parts for general use, and performs its particular function in reproducing other machines like itself. It is thus the offspring of a preceding line of machine tools, and the progenitor of a succeeding line. As in the case of man, its faults and virtues will in a greater or less degree be transmitted to all its descendants. All progress in the way of machinery is therefore ultimately dependent upon the development and perfection of machine tools.

America has justly been proud of its record in this line of world progress. It is a rule almost without exception that the thing which can be done by machinery is more perfectly, and generally more cheaply, done in America than anywhere else on the globe.

There is one particular machine tool which is the machinist's expert man-of-all-work. This piece of versatile machinery is called the universal milling machine, and was originated and perfected by American mechanical genius. It is capable of performing a greater variety of mechanical operations than any other single piece of machinery; and not only does it excel in the variety of its product, but in the accuracy of the results obtained as well. To such perfection has it been brought in this country that it may well be classed as an instrument of precision, as well as a machine tool. The basic element of the milling machine is the re-

FIG. I.—NIGHT VIEW IN AN UP-TO-DATE MACHINE TOOL WORKS; PHOTO TAKEN BY ARTIFICIAL LIGHT.

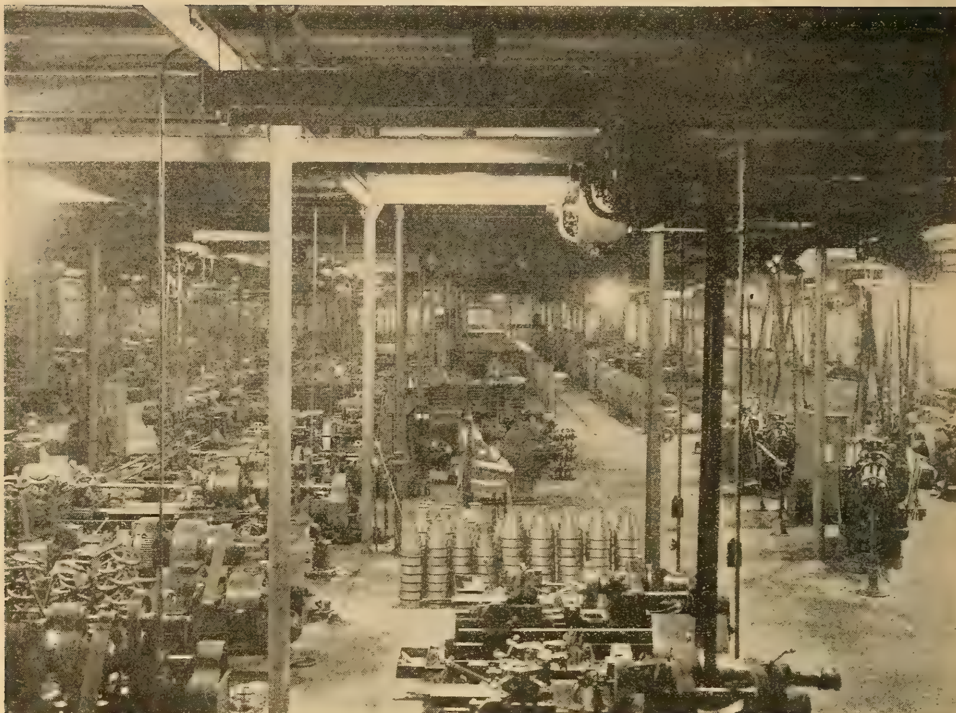


FIG. 2.—MODERN MACHINE SHOP LIGHTING; THE WHOLE ROOM ILLUMINATED LIKE DAY.

volving cutter, which involves the same principle that is utilized in the planing machine and other wood-working tools, to which it was first applied. It is safe to say that this simple device has had a more revolutionary effect upon the working of wood and metals than any other single principle ever applied to machinery.

The foregoing observations are made as a matter of general interest and in order to give a better understanding of the problem of lighting the works in which machine tools in general, and this masterpiece of mechanism in particular, is made. It will be evident from what has been said that the making of milling machines requires not only the highest degree of skill on the part of the workman, but the best possible facilities, among which light will readily be conceded to be first.

In order to secure this condition two things are necessary: a factory constructed on modern plans, so as to afford the best possible daylight illumination, and the use of the most approved artificial light-sources in accordance with the best practices of illuminating engineering.

One of the largest producers of milling machines in this country has provided both natural and artificial light according to the principles above set forth. The works consist of a modern steel building constructed so as to give the maximum daylight in every part without admitting the direct rays of the sun, and its system of artificial lighting is such as to give substantially the same illumination by night as by day. The latter is accomplished by the use of Cooper Hewitt lamps placed on a level with the roof girders, and at such intervals as to produce a uniform general illumination throughout the space below of such an intensity as to enable all work to be performed as by daylight. Only in a few cases where it is necessary to see inside of a hollow casting, or some similar contingencies, are special lights used.

That such a result is obtained is fully brought out in the photographs reproduced herewith, which were taken at

night entirely by the light as regularly furnished, and reproduced without retouching.

Many machinists will remember the days when their only recourse when daylight failed was a flaring gas jet suspended somewhere above the tool or bench, or even a smoking oil torch. Of course, it was not expected of an operative in those days that he would turn out the same quantity or quality of work by artificial light as by daylight. The contrast from such a condition to that of the lighting shown in the illustrations is indeed remarkable.

Equally noteworthy is the wonderful advance in the accuracy of work turned out. Sir Joseph Whitworth, one of the great pioneers in developing tools of mechanical precision, and in standardization, has recalled the time when the machinist who fitted a piston-head to a steam cylinder was quite satisfied with his job if, when the head was placed in the cylinder, a shilling piece would not slip through at any place! When this is contrasted with modern milling machine work, which is measured with micrometers in ten-thousandths of an inch, the refinement of mechanical processes within the past two generations can be realized. But this difference in mechanical accuracy is no greater than the difference between the old and new methods of lighting, and it is certainly no stretch of the fancy to attribute the former progress in some measure to the latter.

The following technical data will be interesting to illuminating engineers and those charged with the responsibility of providing the lighting facilities.

Figs. 1 and 2 are views taken from different positions of a lighting installation consisting of 90 double tube Cooper Hewitt Lamps, and 24 single tube lamps.

In the large crane aisle the lamps are hung 24 ft. above the floor, and in the other section of the shop 16 ft. The lamps run on a 220-volt direct current circuit, and consume a total of 39.3 kilowatts, or an average of .41 watts per square foot. This is slightly lower than the wattage generally figured in such cases, but the resulting illumination has proven ample for the purpose.

A New Lighting System for Industrial Work

An Ingenious Use of Small Electric Lamps

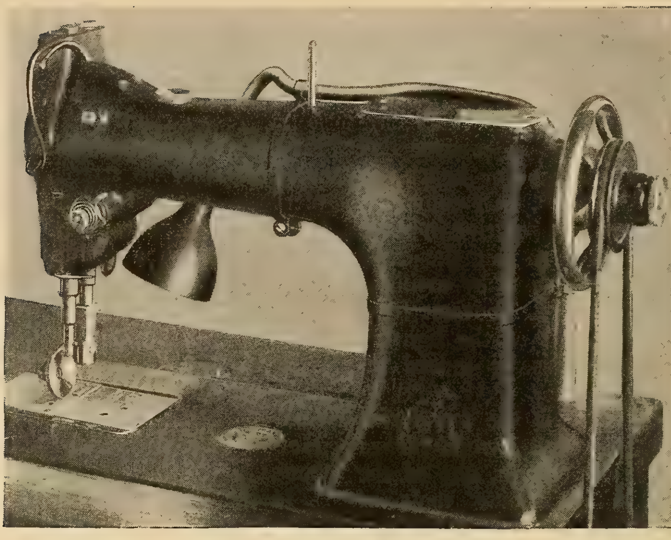
By J. W. Love.

During the past year there was developed a system of specific lighting for the purpose of economically lighting all kinds of small machines where it is necessary for the operator's attention to be centered on a small area as on different classes of sewing machines.

At first this system was developed particularly for machines used in the manufacture of shoes, such as stitching, eyeletting, vamping, embossing, skiving, etc. But it immediately created such an interest throughout the industrial world that it was soon extended to take in a broader field until now this system is used on machines in connection with the manufacture of shoes, cloaks, skirts, shirts, gloves, overalls, etc.

Although the system was brought to light only last year, yet it was in the course of development for a long time, and was evolved to fill a long felt want.

Manufacturers in the textile and leather goods lines have realized that the old method of illuminating their machines and factories was not the most efficient. In fact, any one who has observed the ordinary method of lighting the work on individual machines by the use of large glaring arcs, drop lights, etc., cannot but realize that this method of illumination is expensive at its best. It could be cheapened considerably if high efficiency Mazda lamps were used instead of low efficiency carbon lamps, but even then it would be inefficient because of so much of the light being used to light waste space. There is no logical reason



POWER SEWING MACHINE LIGHTED WITH "MINIATURE" ELECTRIC LAMP.

for lighting the ceiling where no work is being performed. On the other hand, where the light is wanted and in fact the only logical place to concentrate it, is on the work—right down at the needle point. It was to accomplish this very thing that this system of specific lighting was developed.

The accompanying illustration shows one of the fixtures in this system as it is attached to a W & W class 61 machine.

The fixture consists of a small, heavy brass tube bent to fit closely to the body of the machine and which holds rigidly in its proper place a scientifically designed reflector socket of thick brass. The fixture is made in one solid piece and is fastened to the machine by metal straps so that it actually becomes a part of the machine itself. It is impossible to jar loose either the fixture or any of its parts and it can be thrown back with the machine without being removed.

The Mazda lamp used is only 1 inch in diameter. It takes but 5.5 watts of electrical energy whereas an ordinary 16 candle-power carbon lamp takes 55 to 60 watts. The actual cost for operating each fixture is therefore reduced to 1-11 of that of a 16 candle-power carbon lamp.

Scientific experimenting and investigation has developed the fact that a semi-parabolic reflector of about 2⅛ in. in diameter and of the proper design will so collect the light from a 4 candle-power Mazda lamp that instead of only 4 candle-power being thrown immediately in its front a total of 8.7 candle-power will be concentrated there, which is far more light than is secured by the old method. Hence the use of the 4 candle-power lamp in this new system.

The reflector on the fixture by being placed within about 6 in. of the needle point throws and concentrates the light right down at the needle point where the work is being performed, thus eliminating all shadows and at the same time protecting the eye from all glare, in which case, there is no eye strain or eye fatigue. It is because of this and also because only 1-11 as much heat is generated as is produced by a 16 candle-power carbon lamp, that the operators like the new system so well.

Even the small amount of heat that is produced is removed from close proximity to the operator's head.

Manufacturers are commencing to realize more and more every day that the size of their profits depends largely upon the efficiency of their operators and the efficiency of those operators in turn depends to a large extent upon their health

and general satisfaction. Therefore, any device which will save the operators' eyes, protect their health, and in general make them more satisfied, is bound to prove a profitable investment.

The best oculists agree that eye fatigue and its consequent strain results more from glare and the unnecessary light received by the eye under ordinary methods of artificial illumination than from any other defect in lighting. To light up the entire field of vision with an intensity sufficient to make fine details discernible that only occupy a trifling part of this field requires the eye to constantly withstand an unnecesary amount of strain.

Decorative Street Lighting in North Yakima, Wash.

By H. R. Kingman

Some sage recently announced the startling discovery that the blue grass of Kentucky is not blue, but green; and on top of this blow to our cherished traditions comes the proof, substantiated by the truthful testimony of the camera, that the West is neither wild nor woolly, at least not altogether so.

The photograph in question, reproduced herewith, was taken on one of the streets in North Yakima, Wash., a city of some fourteen thousand inhabitants. The point to take note of is the lamp standard in the immediate foreground, which represents one of a company of eighty which have been put in during the present year. The post is of concrete, of a simple design suited to the material, and of especially pleasing outline, surmounted by a 100-watt tungsten lamp enclosed in a twenty-inch opalescent globe.

The abundance of trees and foliage and the distance of the sidewalk from the curb render the illumination problem an unusually difficult one. The posts have been wisely set along the sidewalk, and are but nine feet high so as to prevent shadows from the overhanging boughs. The city is proud of its lighting system and with good reason. It not only is a good thing in itself, but is a substantiated evidence of the pride which its citizens feel in the appearance and prosperity of their city.

The installation was put in by the local lighting company; the city being given ten years in which to pay for it, the total amount being $6,500. The lamps are run all night every night in the year, for which the city pays $20 per lamp. The lighting company's contract at this rate runs for only one year, the assumption being that the people will not willingly dispense with the installation after having the convenience and pleasure which it affords for a year.

The installation was completed and the lights formally turned on on the evening of August 16, and was made the occasion of a general jollification which was participated in by the mayor, the city council, the local commercial club, Y. M. C. A. band and a large gathering of citizens. Both the lighting company, who were originally responsible for the installation, and the city and civic authorities who carried it into execution, have received many flattering comments from visitors on its fine appearance and the progressive spirit which it indicates.

TYPE OF NEW ORNAMENTAL LIGHTING STANDARD USED AT NORTH YAKIMA, WASH.

Modern Gas Lighting in the Home

Difference Between the Old and the New Gas Illumination

BY F. N. HAMERSTROM.

The word "modern" is so frequently used these days that its meaning has become somewhat meaningless—if we may be permitted the contradiction in terms. When applied to gas lighting, however, it signifies something very definite. So different, in fact, is modern gas lighting from the old style "gas light" that there is not the slightest external evidence of the identity of their sources. "Gas-light" as formerly used brought to the mind the gas flame, usually surrounded by a glass shade of a typical pattern which, if fortune were particularly propitious maintained its unbroken entirety, but in less favorable cases was cracked and defaced. Thousands of these old-time gas fixtures still disfigure the rooms in which they are placed, and distress the eyes of those compelled to use their light. Then came what we might call the mediæval period in gas lighting, in which the glass shade was discarded in favor of the imitation "candle," which is nothing more than a short piece of opal glass tubing with a "cup" of some sort placed underneath. This has the advantage of being a little cheaper than the shade, and far less liable to be broken, but leaves the flame exposed, and thus adds to the glare of the light.

Modern gas lighting had its beginning about thirty years ago in the introduction of the Welsbach burner, and this has again been recently improved by the invention of the inverted mantle burner; so that when we speak of "modern gas light" to-day we mean illumination pro-

FIG. I.—LIVING ROOM LIGHTED WITH THE LATEST IMPROVED GAS LAMPS AND MODERN FIXTURE.

FIG. 2.—PERFECT ILLUMINATION OF DINING TABLE WITH MODERN GAS FIXTURE.

duced by this latest and most successful device for the use of the illuminant whose discovery marked the beginning of the age of light.

The best way to give an explanation of any practical device is by referring to examples of its use. The illustrations shown herewith may serve our purpose in explaining modern gas lighting.

Fig. 1 is a view in the living room of a suburban home. The lighting fixture is what is known as a "reflexolier." The lamps are of the most modern type of inverted mantle burner, each of which gives a little more light than the familiar upright Welsbach burner, and burns about half as much gas as an ordinary flame tip. The mantle is entirely hidden by the decorative glass globe surrounding it. The light is turned on and extinguished by pulling a little chain which drops from just above the burner. The design of the fixture, as well as the lamps, is modern, the old plan of a central support with extending arms being entirely discarded, and the lamps dropped from supports after the type of fixture called the "shower." The light given out by these lamps is much whiter than that of the ordinary gas flame, though it is still mellow enough to prevent harshness.

Fig. 2 is a view in the dining room, in

which both fixture and lamp are likewise new. The "dome," or large art-glass shade, is suspended by a device giving the exact appearance of a chain. It is fitted with a single "Reflex" lamp, lighted by the chain as in the former case. The photograph shows how beautifully the table is illuminated. The difference between the artistic appearance of this fixture and the perfect illumination produced, and the awkward looks and flickering and often insufficient light produced by the old-time gas chandelier is as great as between gas light and the tallow dip.

Fig. 3 shows the very latest device in modern gas lighting. The lamp is the same as in the other cases, but it is lighted and extinguished by a simple electrical device. A small battery, known as a dry cell, is placed within the body of the chandelier and supplies the necessary current for turning the valve and igniting the gas. The button or switch for operating the lamps may be dropped on a cord, as in this case, or it may be placed at any convenient point on the wall.

Fig. 4 is another bedroom view, showing the proper location for a lamp in relation to a mirror. This has required a little extra piping, which is well worth the trouble and expense. Of course, this should have been done when the house

FIG. 3.—BEDROOM, WITH LATEST FORM OF ELECTRICALLY LIGHTED GAS FIXTURE.

FIG. 4.—CORRECT LIGHT FOR DRESSING TABLE OR BUREAU.

was built, but architects are unfortunately often remiss in their attention to the lighting problem.

The statement now made by illuminating engineers that it is possible to light a home as artistically and as perfectly with gas as with any other illuminant must be admitted by any one who will consider this single example.

Besides the great improvements in economy, quality of illumination produced and appearance of fixtures, modern gas lighting also includes equally important strides in the way of convenience. The old method of lighting a gas flame with a match or lighter is now as out-of-date as the flame itself. The modern method of lighting and extinguishing is either by means of the "by-pass" or the electric ignition system. The "by-pass" is simply an arrangement by which a tiny "pilot" flame is kept burning when the lamp is turned out. This has the very great advantage of indicating by its own light the location of the lamp, so that there is no need of fumbling around in the dark to find the place where the light is to be turned on. The electric method permits of the lights being turned on or off from any distant point. With these improvements gas now possesses equal convenience with any other illuminant.

In closing it may be noted that the gas mantle also has been greatly improved within the past few years, so that the best mantles now made are much tougher and last longer in use. In many cases an inverted mantle will last two years.

Lighting Problems That are Agitating the Public

How the People are Striving for "More and Better Light"

Chicago Wants Better Street Lighting.

The question of better illumination through every section of the city has been receiving much attention in Chicago for several months past. Although a contract has recently been entered into by which the city is to have 10,000 additional arc lamps of the improved types, supplied with current by the power generated by its drainage canal, there is evidently a general feeling that even this much addition to its present lighting system will not suffice to make Chicago a well lighted city in the present meaning of the term. Mr. Ellis Geiger of the Board of Aldermen has been most active in the agitation for making Chicago "the best lighted city ever heard of," and is demanding 30,000 additional arcs, instead of the 10,000 now arranged for.

The Chicago papers are promoting the project by giving it editorial support. While readers outside of Chicago have no direct interest in this particular case, there are still many cities and towns in the same predicament, and to which the same general arguments will apply.

The following arguments from an editorial in the *Tribune* may be applied to any of these cases:

"If Chicago is to make use of its opportunity to become the center of interest in the Middle West it must offer not only such attractions as have been suggested for the assembly ground on the lake front park, but it must become in itself attractive.

"One item of its needs is light. The authorities no doubt have proceeded on the theory that the first necessity was and is to light the outlying streets for the protection of citizens. The soundness of that theory is beyond question. Until the streets which might be dangerous if left in darkness have been lighted it is not good policy to ask for more lights downtown, but the propositions need not be alternative.

"At present the aspect which Chicago presents to its transient population at night is dingy and sordid. There are downtown blocks which rely solely on lights at street intersections. They would be cañons of gloom if it were not for the illumination in the windows of shops and stores. Many of them, lacking that, are.

"A municipal economy which thus slights the important factor of street illumination is folly. If the effect of gloomy streets be depressing to the Chicagoan, what must it be to the visitor? He has entered a large and expensive looking residence and has found the owner singeing his beard as he tries to read by the light of a candle.

"When a private concern—an amusement park, an advertising firm, etc.—wants to attract and hold public attention, to interest it and use it, the first thought is of lights. With reckless prodigality great masses and clusters of lights are used.

"We do not envy New York Broadway, but we do envy the lighting of it. Let the New Yorkers reduce it to the illuminative standard of Dearborn street, for instance, and it will be about as lively as the main street in a country village after 11 o'clock at night.

"If Chicago is to meet its opportunity it will make its streets look as if they were intended for cheerful human uses."

The *Examiner* thus summarizes the case:

"1. Once Chicago is known as the City of Light, we assume a stellar position.

"2. Our present poorly lit streets and alleys are both a shame to our city, which we have to apologize for, and a jungle of terror to all strangers.

"3. Lighting our streets properly makes their night traversing as safe as in the day, for criminals prefer dark streets and alleys.

"4. We save millions of damages to Chicago to those hurt at night on ill-lit streets, on sidewalks and in street holes.

"5. Millions will be gained in property values, especially where now people shun streets because they fear them and criminals.

"6. The Sanitary District can cheaply and easily supply us with all the lighting power we need. Chicago paid for the district—let Chicago use it. Were Chicago light as day, as are small European cities, especially in Germany, we would double our happiness; we could see our girls and boys safe and ourselves enjoy life more by walking about safely at night.

"A million Chicagoans would leave their heated houses and crowded porches to seek free enjoyment, fresh air and double pleasure on our streets at night, where now only a reckless ten thousand dare go farther than a block in the heavily settled districts."

New Haven, Conn., Has an Electric "White Way."

Seventy-six inverted luminous arc lamps of a new type were turned on in New Haven on the evening of December 15, flooding Church and Chapel streets with white light and making New Haven a city with a real White Way. The cutting into service of these lamps was attended with appropriate ceremonies, and was witnessed not only by the citizens of New Haven, but also by prominent lighting experts and by visiting delegations from several large cities. The decorations throughout the city were the most attractive and artistic ever produced, and a monster parade was a feature of the celebration.

It is estimated that 100,000 people were on the streets.

The lamps installed are inverted series luminous arc lamps, combining high illuminating efficiency with adaptability to ornamental lighting.

The lamp casing constitutes the capital of the supporting post or column, and is so designed that by releasing a latch it may be lowered to give free access to the lamp mechanism as readily as the similar operation is accomplished on an ordinary arc lamp.

Within the base of the pole an absolute cutout is placed, so that the trimmer may disconnect the lamp from the line before starting to work on it.

In operation and design the mechanism is essentially the same as that of the standard mechanism of the direct current series luminous arc lamp, of which more than 75,000 are now in operation. The arc is struck between a stationary non-consumable copper upper electrode and a movable magnetite lower electrode burning under normal updraft conditions. A single side rod supports and carries the electrode, fume dome and chimney.

The lamp is equipped with a diffusing globe that is unique in design, in that it is perfectly filled with light, and no circular shadows are cast upon it by the electrodes. The globe may be removed without disturbing the alignment of the electrodes. A large ash pan is provided which is easily removable. By using the new specially designed diffusing opal globe, which furnishes a beautiful secondary source of pearl white light of high efficiency and low intrinsic brilliancy, it is possible to place the lamps at the extremely low height of 14½ ft. without producing a glare.

School Buildings as Social Centers.

Those of us who got our early education in the old-time academy or seminary have regretted the passing of this type of institution on account of the social life which was an important part of its existence. The modern graded or high school may have greatly improved methods of teaching and discipline—though of this fact we are by no means fully persuaded—but compared with the boarding school, it is a soulless and bloodless affair. There is more or less agitation throughout the country toward utilizing school buildings and grounds for other purposes than the mere class instruction of boys and girls. In the larger cities night courses of instruction and special lectures are becoming more and more common, and from at least one small town comes the report of a still greater innovation, viz., the use of the school building as a place for social evening gatherings. It appears that the Mothers' Club of Rossville, Richmond County, N. Y., conceived the very happy idea of having "Fathers' Night," which was held in the public school building. The occasion was apparently a most happy and successful one, with the exception of the gloom cast upon it by the makeshift illumination which was provided. The building apparently was supplied with neither gas nor electricity, and hence oil lamps had to be brought into requisition. It seems strange that there should be in existence a school building where these modern facilities are obtainable that should not be equipped for their use; but in this respect the Rossville schools are only a degree worse off than those in New York and other cities, large and small. In New York City alone there are more than sixty school rooms which require artificial light regularly during the day, and such lighting as is furnished, whether with gas or electricity, is crude and out of date.

The increasing use of school buildings

in the evening adds to the importance of having the best possible artificial light. It is no less criminal to allow glaring or insufficient illumination in rooms where children have to do close eye work than it would be to neglect the other sanitary necessities. If there is any one place that needs good light whenever it is in use, it is a school room. With the methods of artificial illumination now available, it is possible to practically equal the best daylight conditions with artificial light, and to have anything less than the best in this regard is inexcusable from any and every viewpoint.

The New Method of Lighting Gas Street Lamps.

The lamplighter with his torch, who has been making his nightly rounds to light up the street lamps, is to be superseded. A number of devices have already been in successful use in Europe for several years by which the lamps are turned on and lighted from the gas works, or from a sub-station, just as easily and quickly as the electric lamps are switched on. We Americans generally imagine that we lead the world in improvements, but as a matter of fact, Europe sets the pace in many cases. This has been particularly true in the field of lighting. All of the recent improvements in both gas and electric lamps have originated in Europe, mostly in Germany; and we have been slow in taking up a number of improvements that have come into general use abroad, among which are the high pressure gas lighting and automatic methods of controlling gas street lamps.

The introduction of the latter improvement seems to have run against a political snag in at least two cases in this country. An ordinance was universally passed by the Council of Cleveland, Ohio, authorizing the receiving of bids for the lighting and extinguishing of the gas lamps, both by the new automatic devices and by the old method of personal lighting. It was suddenly discovered, however, that the ordinance was "illegal," and there is a decided effort being made to prevent the receiving of bids for the automatic device, although it is claimed that by its use the city would be saved $10,000 a year.

In Boston, also, the same matter has been sidetracked in the call for bids for street lighting. In the latter case about one hundred lamplighters are employed by the city. It does not require any particular astuteness to see where the objection to automatic lighting arises in these cases. To sweep away one hundred "jobs" from the city government is not to be done lightly or without due regard to the vested interests of the lighters—and their votes.

Good Lighting Should Include Residences.

Those who have had the experience of looking for a residence at night at a certain number on an outlying street in a strange town or city will need no persuasion as to the desirability of lighting up the porches and entrances of the residential section. Further than this, dark porches and windows give the same gloomy appearance to a residence street that unlighted show windows do to a business street. The movement for decorative street lighting, which has spread so rapidly throughout the country, has shown the people what light means to the business section of a city. The movement to extend this to the residential section has begun, according to a note in the Louisville *Post:*

"Upon the suggestion of J. T. Searle, vice-president of the Rochester Railway & Light Company, an effort is being made to start a campaign for better lighted homes in Louisville than prevails at the present time.

"Mr. Searle was in Louisville recently and made a trip over the residence sections of the city at night. He was impressed with the fact that in the great majority of homes, even in the fashionable residence districts, there were no lights to be seen from the street. He said that a campaign along this line prosecuted in Rochester recently resulted in a distinct improvement in the lighting of homes. He said residences in the electrically served sections of Rochester now have lights either on the front porches or in the halls from dusk until 9 or 10 o'clock, and that the city consequently has a distinctly better appearance."

Fixtures and Accessories

Some Recent Examples of "Arts-and-Crafts" Fixtures

The school of decorative art which calls itself "Arts-and-Crafts" is undoubtedly extending its influence in this country. Its reason for existence is to be found in its originality and a complete abandonment of tradition and historic motive. Tolstoi, in the discussion of the question, "What is art?" expresses the opinion—and his opinion on any subject is worthy of respectful attention—that the very essence of art is in transmitting a new impression. To simply express what has already been expressed before, as in the case of copying or simulating, or to convey a feeling that is already familiar from experience, is not art, according to his conception of the term. However, the student of philosophy and esthetics may differ with this opinion. It is beyond dispute that if Tolstoi's contention were accepted we should be saved an enormous amount of copies, *ad infinitum,* of motives that have been trite for ages, and would witness a much more vigorous growth of new conceptions.

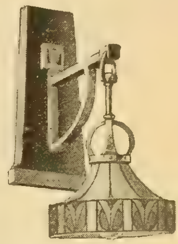


FIG. 2.

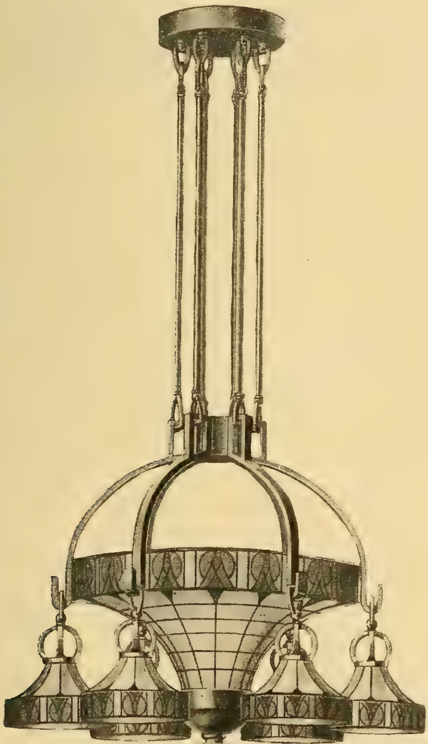


FIG. I.—CHANDELIER COMBINING BOWL AND PENDANTS.

The "Arts-and-Crafts" school is, to a certain extent, an effort in this direction. It is a protest against the traditional forms of decoration and construction that have come down from antiquity, and likewise a protest against the modern machine-made repetitions that have monopolized the field in America. The ideal of the craftsman piece of furniture or interior decoration is the working out

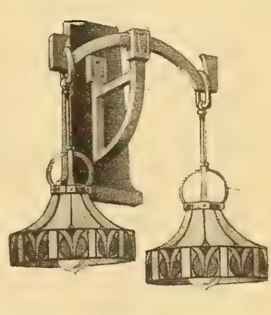


FIG. 3.—BRACKET, WITH ART GLASS PENDANT SHADES.

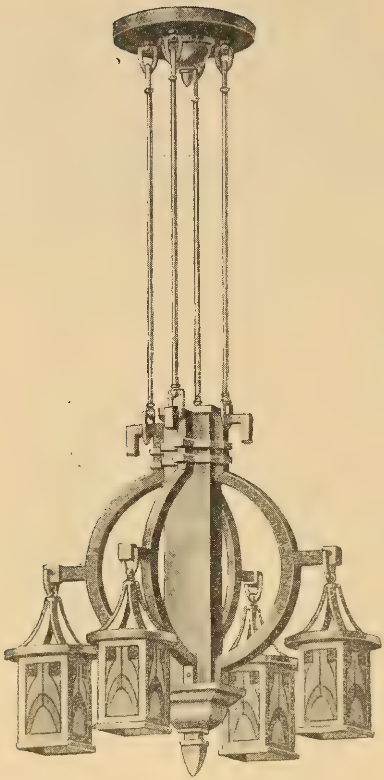


FIG. 4.—CHANDELIER, WITH ART GLASS LANTERNS.

of the conception of a single individual by his own hands and with only hand tools. The results are, therefore, characterized by a certain type of simplicity, combined with ruggedness of construction. The keynote of the effect is the evidence of the human touch. "Arts-and-Crafts" might well be called "the simple life" applied to decorative art.

Lighting fixtures, when not treated as mere mechanical appliances, must be considered as works of decorative or applied art. They thus necessarily form a part of the decorative scheme of the interior in which they are used. Since the "Arts-and-Crafts" school has made for itself an established place it is essential that its motives be applied to the design of lighting fixtures.

FIG. 5.—BRACKET LANTERN.

In a recent catalogue issued by a Chicago manufacturer almost the first fixtures shown are of this school of design, from which the illustrations given herewith are taken.

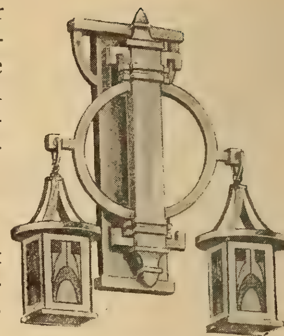


FIG. 6.—DOUBLE LANTERN BRACKET.

Fig. 1 is a chandelier provided with six pendant electric lamps and a central bowl. The metal supporting parts are of brush finished brass, the shades of leaded art or cathedral glass, having the principal portion in light amber, with decorations in neutral green, blue and dark amber.

Figs. 2 and 3 are side brackets to match.

Fig. 4 shows a four-light chandelier, with shades of lantern form in leaded art glass.

The corresponding brackets are shown in Figs. 5 and 6.

Fig. 7 shows another treatment of the bracket.

It is conceivable that the artisan could produce the metal work of these fixtures with no more elaborate tools than a compass, saw, hammer, common plane and file, with the addition of a few pieces of brass rods or tubing; and this exemplifies the spirit of the art which they display.

Fig. 8 shows a combination of what would be called a ceiling bowl and a "shower" in the parlance of the fixture trade. The spirit of the design is well maintained both in the glass and metal work, and the general effect

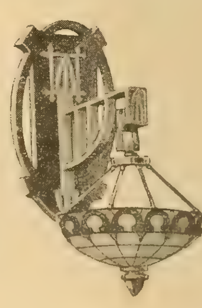


FIG. 7.—"SEMI-INDIRECT LIGHTING" BRACKET.

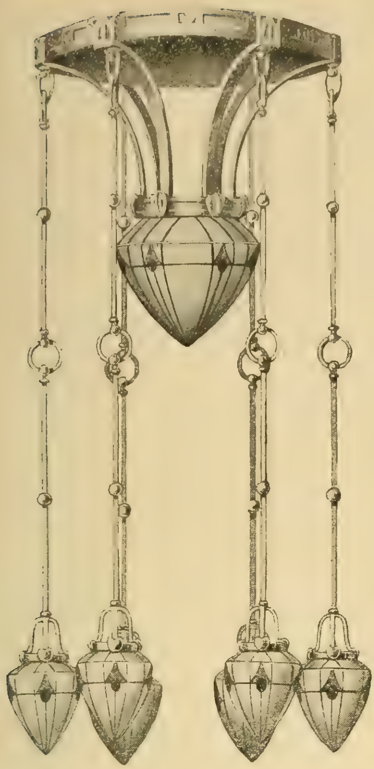


FIG. 8.—COMBINATION "SHOWER" AND CEILING BOWL.

possesses rather more grace and lightness than is common in this school of art.

Fig. 9 is the corresponding side bracket, which is equally pleasing in its lines.

In regard to "finish," which determines the apparent material of which the metal work is constructed, there are three possible variations: brass, bronze and iron, so treated as to carry out the idea of hand work. The finish regularly supplied by the manufacturer is brushed brass, *i.e.,* brass having a dull surface, and showing the slightly greenish-yellow color of the unlacquered metal. The wrought iron finish would be more suitable for the side brackets.

Whether these designs will appeal to the reader or not depends entirely upon his conception of decorative art. If he is of the conservative type, which prefers to adhere to conventional and historic models, the examples shown here will appear mere freaks, originating only in a desire to be different and novel. If, on the other hand, the reader is of an inventive turn of mind, and thus an admirer of originality and freshness of conception, the motives shown will make a distinctly favorable impression.

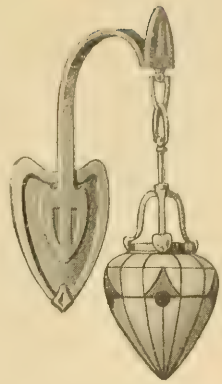


FIG. 9.—BRACKET, WITH STALACTITIC SHADE.

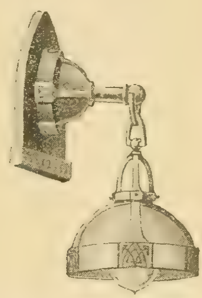


FIG. 10.—BRACKET, WITH DOME SHADE.

In few words, if you admire the "Arts-and-Crafts" school of decoration, here are lighting fixtures to match; if you prefer the historical "periods," then they have no interest for you. Like all other innovations, the designs will at first naturally appear strange and, doubtless, to many uncouth, but this is simply due to the fact that our tastes, in common with our general habits of life, run more or less in ruts, and anything which tends to throw them out at first gives us something of a jar. Some of us, like the Athenians of old, are constantly seeking for some new thing, while others prefer to enjoy the tranquility of the established order of things.

Improving Lighting in the Cloak and Suit Industry

The "First Annual Report of the Joint Board of Sanitary Control in the Cloak, Suit and Skirt Industry of Greater New York" has been issued under date of October, 1911, from the offices of the Board, 58 Bible House. The work of this board has been mentioned before in these columns, and is deserving of the widest publicity and commendation. The causes leading up to the appointment of this Board, its organization, and the work carried out under its direction during the year, furnish one of the most interesting and fruitful topics of study of all the large array of sociological and industrial phenomena of the past decade.

A summary of the whole situation is given in a most concise, but comprehensive foreword in the report of Mr. Louis D. Brandeis, which we give in full.

"The settlement of the great strike of the New York garment workers in 1910 and the relations between employers and employees, thereby established, constitute one of the most hopeful chapters in American industrial history. An important trade, involving nearly 1500 separate concerns, employing about 60,000 operatives, was paralyzed by industrial war. Patient, open-minded, intelligent consideration of the conditions of the trade by representatives of capital and labor in joint conference, led, not merely to the resumption of business, but to securing industrial peace. This happy result was obtained not by 'splitting' differences, but by constructive measures designed to remove grievances. Neither party compromised a principle nor conceded an unjust demand. Both parties recognized that means and methods for improving the difficult relation of employer and employee were proper subjects for study, for invention and for experiment. Courageously they adopted new devices, the 'Preferential Union Shop,' and a 'Joint Board of Sanitary Control.' They developed an effective system for investigating and adjusting grievances; and by sympathetic, painstaking and able consideration of the practical difficulties arising from day to day in the introduction of a new system, the large minded representatives of employers and employees overcame adverse conditions and achieved success in an incredibly short time."

The board undertook the investigation of all shops in the industry in Greater New York, and repeated this investigation at the end of the first half year. In this investigation due attention was given to the matter of light and illumination, the two words in this case signifying natural and artificial lighting.

On this point the report says:

"The investigation of the cloak-making shops has shown that in nearly one-third of the shops, or in 374 out of 1200, artificial illumination was needed and used during the day. In the August, 1911, inspection, when conditions were naturally more favorable, there were still 294 shops where artificial light was used during the day in some parts of the shops. . . .

"During the February, 1911, inspection it was found that 60.65 per cent. of the shops used illuminating gas, 25 per cent. both gas and electricity and 14 per cent. electricity, exclusively. The August, 1911, inspection showed 1086 shops out of 1738 using gas, 382 electricity and 257 gas and electricity.

"Where gas illumination is used the light comes from ordinary gas pipe, two to four arm chandeliers, fitted with ordinary flame tips. Very often gas pipe arms are made to descend to the machine and are protected by wire guards to prevent the material from catching fire. The number of shops where incandescent mantles are used is comparatively small, and still fewer are the shops

where a good kind of incandescent arc light is found.

"Where electricity is used the light comes, as a rule, from ordinary 16 c.-p. incandescents, metal filament lamps being the exception. In but few shops is there any attempt to furnish a larger amount of light, which is so easy and possible with modern gas as well as electric lamps.

"In 17 per cent. of the shops inspected during February some attempt was made to protect the eyes of the operatives from the glare by suitable shades and globes. Some sort of a shade was found in 466 of the 1738 shops inspected in August, 1911, but few of these shades answered the purpose of protection from glare. In some of the shops powerful reflectors were put in in connection with 60 to 100 watt tungsten lamps, producing an intense light very harmful to the eyes of the workers.

"The inspection undoubtedly shows that no thought whatever has in the past been given by the employers to the question of adequate and proper light in the shops, to preserve the eyes and promote the health of the operatives."

This is certainly a severe indictment against the employers in this industry, but there are some mitigating circumstances. The lighting conditions are certainly no worse than the general conditions of sanitation, fire protection, etc. Furthermore, it is not at all unlikely that a similar investigation in many other industries in which the work can be performed in small shops would disclose no better lighting conditions. As a result of the investigation of the board and the special reports by experts in the several branches of sanitation and safety, a code of requirements was laid down in which the following are the specifications for lighting:

"Halls and stairways leading from shops to be adequately lighted by natural or artificial light.

"Sufficient window space to be provided for each shop, so that all parts of the shop be well lighted during the hours from 9 a.m. to 4 p.m.

"Where gas illumination is used arc lights or incandescent mantles should be used.

"All lights to be well shaded, to be placed above operatives and not too near them."

While these requirements are obviously not rigidly specific, they are perhaps as definite as would be practicable as a first move toward betterment in this direction. It will require some degree of education on the part of employers before more detailed technical instructions can be followed, and it is far better that an imperfect regulation be enforced than that an ideal one be a dead letter.

The most significant part of the whole question is the recognition of both employer and employee, that the physical well-being of workers is equally essential from both standpoints. The full recognition of this fact would go farther toward solving the labor problem than any other single act, if in fact, it would not solve it altogether.

Lighting Companies as Social Reformers

The question of old age pensions is a live political issue in Great Britain, but in this country the subject is being practically taken up by the various large industrial corporations. In this work none have been more active and progressive than the lighting companies. Not only the pension system, but the general welfare of the employees was made the subject of a special session of the National Electric Light Association at its convention last June. As this association now numbers more than ten thousand members, and represents more than ninety per cent. of the money interest in the production of electricity in this country, the extent of its power for promoting social reforms may be appreciated.

The most recent case is that of the Consolidated Gas, Electric Light & Power Company, of Baltimore, which, at the meeting of its Board of Directors on December 6, adopted the following plan:

"1. Any employee who attains the age of 65 years after 15 years' continuous service.

"2. Any employee who, after 20 years' continuous service, is by reason of permanent physical or mental disability, unable to follow his usual employment in the company's service.

"3. Any employee after 10 years' continuous service who shall become incapable of continuing in service by reason of injuries received while at work in the employment of the company.

"The detailed plan for the application of the pension principle to the classes above mentioned is such as to result in very liberal treatment of the company's employees. It is provided that the entire cost of the pension system shall be borne by the company. The system calls for no contributions from the employees themselves."

"Let Well Enough Alone"

Like most other popular proverbs, this one is good to follow, but within limits. There is a wise and a foolish conservatism; the former holds on to what has served the purpose until quite sure that there is something better, and then makes the change; the latter changes as often as it can obtain something different. As to lighting, the wise conservatism should naturally be practiced. There may very possibly be better methods of lighting than those you are now using; but unless you are quite sure that the other systems proposed are a distinct improvement, there is no occasion to change.

There are still some salesmen who are quite ready to persuade a customer by all the arts known to their cult that what they are selling is better than what he is using, regardless of the facts in the case. Such salesmen specially plume themselves on a sale of this kind. If they are dealing with a consumer who is not particularly well versed in the line of goods that they are handling, such persuasion is by no means a difficult task.

Unfortunately, this kind of salesmanship is occasionally found in the lighting industry. A customer puts in a lighting installation which, he is told with all the eloquence and logic at the command of the salesman, is the very latest and best method in existence. He uses it with apparent satisfaction until, a few months later, another equally persuasive salesman appears with an entirely different system and argues him into believing that the one he has is all wrong and the one that the salesman has is all right; and so a change is made. Within another few months the same thing may be repeated, or the original salesman may discover his customer's defection and persuade him to go back to his original method. We have observed such changes two or three times in a year in some cases.

It is perfectly evident to the disinterested observer that such tactics on the part of the salesmen are wholly unethical and therefore bad business policy. While they may result in a commission for the salesman himself, they are sure to react upon the concern which he represents. Such actions should, therefore, be discouraged with all the vigor possible on the part of the manufacturers of illuminants and apparatus. There are antiquated, faulty and inefficient lighting installations enough to work on, in all conscience, without changing the recent and fairly good installations.

To the users we would say: If your lighting system has been put in within the last three years do not change it without the advice of an illuminating engineer known to be independent and disinterested. It may pay you to make changes even in an installation put in within a year, but the matter is of sufficient importance to make it worth while getting impartial advice. You would not go to the attorney on the other side for advice in a lawsuit, and no more should you expect disinterested advice from a man who is endeavoring to sell you a different make of goods. Impartial advice may cost something, but it is the cheapest in the end.

Keep Your Lighting Apparatus Clean

What would you expect in the way of looks and light if you let your windows go six months or a year without washing them? And yet this is what happens in innumerable cases with lighting glassware and fixtures. The conveniences and comforts of civilized life are not to be obtained without care, and the more artistic and expensive they are the more care they require. If you are satisfied with an ordinary bat-wing gas burner as a source of light you need trouble yourself very little about keeping it in order; but if you prefer the electric light or the modern gas lamp, equipped with glassware which diffuses and softens the light so as to produce daylight illumination, and especially if you think it worth while to enjoy the beautiful and artistic effects that are obtainable with modern lighting appliances, you must make up your mind to give them somewhere near the same attention that you give to your bric-a-brac, your upholstery and your other choice furnishings.

When your piano gets out of tune you do not call up the manufacturer and then call him down for furnishing you an imperfect instrument; you politely send for

the piano tuner and have it put in order.

When your rugs get soiled you send them to the cleaner, or perform the necessary cleansing in your own home. When your light falls off, do you follow the same reasonable course, or do you blame the lighting company for the deficiency and accuse them of running fast meters and juggling your bill?

If there is any one thing in the house outside of your kitchen that it pays to keep scrupulously clean, it is your lighting appliances. Light costs money, even if it is cheap; and every bit of dirt or dust on a globe or shade represents a loss of light and hence a loss of money, to say nothing of the inconvenience and discomfort of poor light. Whenever you wash your windows see that your lighting glassware gets the same treatment, and you will be surprised at the continual brightness of your home, and the few occasions that you will have to complain of big lighting bills.

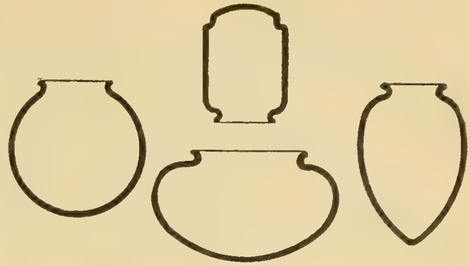
Classification of Illuminating Glassware

In the October issue we set forth the confusion that has arisen in the classification of illuminating glassware both in regard to the character of the material and the shape of the article, and suggested that the subject be taken up by manufacturers and technical societies concerned with illumination, and a classification and nomenclature agreed upon.

The Safety Heating and Lighting News, for November, takes up the problem, and makes a tentative proposition for such a classification. After a very logical and comprehensive analysis of the subject, the writer deduces the following system of classification:

Globe—One piece of glass, completely enclosing a light source,
Bowl—A glass form having but one opening which is at the maximum diameter,
Dome—A glass form used for combination only with a bowl to completely enclose a light-source,
Shade—Any glass form which only partly encloses the source of light,
Reflector—Any opaque form used to redirect light rays.

This is at least a good beginning; in fact, there seems to be little to object to in the scheme as laid down. The defin-

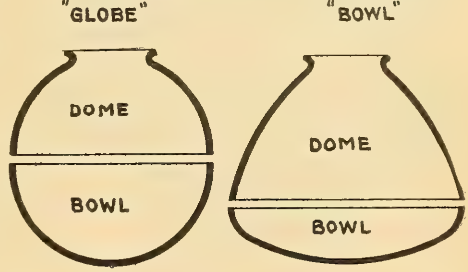


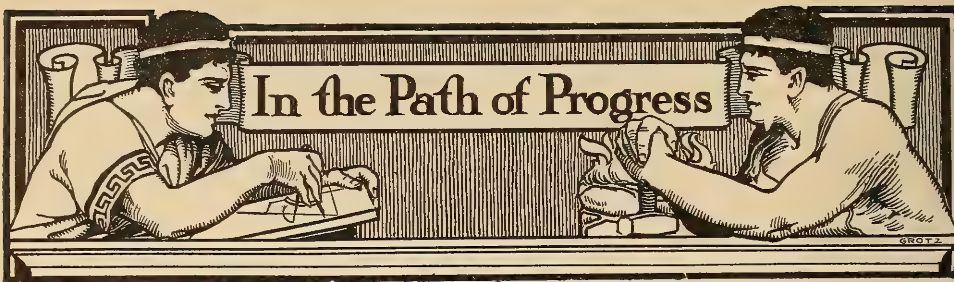
DIFFERENT FORMS OF GLOBES.

ition of dome perhaps comes farthest from meeting the present acceptation of that term. In fact, the definition is included in that of "shade." The following definitions are suggested as conforming more nearly to the present use of the terms:

Shade—A glass form having two opposite openings, one of which is used for its support,
Dome—A shade of large size requiring a special fitting or fixture for its support.

The writer of the article quoted, suggests that these general terms may be qualified when necessary. Thus, a shade that is intended chiefly for reflection, such as the prismatic and white glass shades now so largely in use, might be termed a "reflecting-shade." It is interesting to note that this compound term has been recently adopted by a manufacturer of lighting glassware. A shade which is intended primarily for diffusing light would then be called a "diffusing-shade."





New Designs in Indirect Lighting Units

The rapidly increasing demand for indirect lighting units suited to large interiors has necessitated the design and manufacture of an extended line of this type of fixtures by the National X-Ray Reflector Company, Chicago, who have done so much to cultivate this particular field through their Eye Comfort System of Indirect Lighting.

The illustration shows one of these new patterns. Both in contour and ornamentation this unit is of pure classical design, and will meet the requirements of the large number of public buildings in which this type of architecture generally prevails.

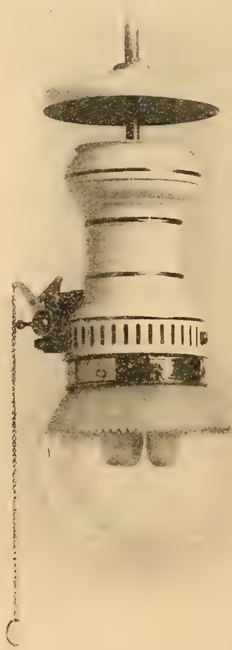
Drawings or photographs of other fixtures of this type will be gladly furnished by the manufacturers.

A NEW INDIRECT LIGHTING UNIT.

A New Humphrey Gas Arc

The General Gas Light Company, Kalamazoo, Mich., are now marketing a new inverted mantle gas arc lamp. The following description has been furnished by the makers:

"The Humphrey No. 30 gas arc lamp illustrated herewith is a new type of gas arc



THE NEW NO. 30 HUMPHREY INVERTED ARC.

lamp now being put on the market by the General Gas Light Company, Kalamazoo, Mich. The aim of the makers has been to produce an ideal maintenance lamp, and while the new type has the same outward appearance of the older inverted lamp, the mechanism has been entirely changed and simplified with the result that it will operate efficiently over a greater range of gas conditions than any lamp heretofore produced. In addition to this the efficiency has been increased to over thirty-seven candles per cubic foot of gas, the test being made by the Electrical Testing Laboratories, New York, at 3.5-in. pressure and the lamp equipped with clear globe and no reflector. Gas consumption, 12.28 cu. ft.; maximum candle-power, 458.

"The three most important features of the new mechanism are the one-piece removable valve, the vertical cartridge screen and the single needle point gas adjustment and air mixture baffler. The valve may be removed by simply loosening one bolt. These valves can be removed and replaced in less than half a minute, and are interchangeable for all sizes of both indoor and outdoor lamps.

"The gauze or screen consists of a vertical cartridge which is placed in the burner head close to the point of combustion. With one turn of the pliers the screen can be removed for inspection or cleaning. The screen, being in a vertical position, it is largely self-cleaning, as dust and dirt falls to the bottom of the screen instead of lodging in the gas way. The position of the screen is at the center opening between the burners.

"When maintenance figures are excessive, it is generally due to the fact that lamps are either turned down or not turned on full, with the result that the mantles carbonize. At a recent demonstration a lamp was turned down so low as not to incandense the mantles, and yet the mantles burned without carbonizing or lighting back."

New Publications

"From Post-Hole to Lights On."

This is the title of a booklet of sixty pages, issued by the Sterling Electrical Mfg. Company, Warren, Ohio. It is "a treatise on the Mazda lighting system covering all information, data and cost." The book is printed on coated paper, profusely illustrated with half-tones, showing various types of lamp standards, lamps, glassware and various accessories used in this kind of lighting. The various items of cost entering into street lighting of this type are given in detail, together with definite information on all practical points connected with the subject. It is an exceedingly valuable treatise for city engineers, municipal authorities, civic associations and all others directly interested in the problem of decorative street lighting.

"Warren Beautiful."

Under this title the Sterling Electrical Mfg. Company, Warren, Ohio, has issued a very handsome brochure, thirty-six pages and cover, containing a reprint of a paper on the ornamental lighting system of Warren, which was prepared for a private gathering by Mr. William Coale. It gives a full account, not only of the lighting system, but the history of the movement which led to its adoption. To this is appended a copy of the contract between the city and the local lighting company. To those who are interested in the promotion of the "City Beautiful," as applied to their own town, this booklet will be a source of inspiration.

Personals

Mr. C. W. Stone has been appointed Manager of the Lighting Department of the General Electric Company to succeed Mr. C. D. Haskins, deceased.

Mr. Charles E. Ummach who, in his fifteen years of service as Secretary of R. Williamson & Company, fixture manufacturers, Chicago, has made for himself a host of friends in the lighting field, has resigned his position with that company, and becomes the president of the Ummach Manufacturing Company, which will succeed to the business of the W. S. Edwards Manufacturing Company, fixture manufacturers, also of Chicago.

Mr. J. G. Pomeroy, formerly Western Sales Manager of The Adams-Bagnall Electric Company has been appointed Sales Manager of the company, with headquarters in Cleveland. Mr. C. L. Eshleman has been appointed Publicity Manager, with headquarters in Cleveland. A Boston office has been opened under the management of Mr. E. R. Bryant, formerly connected with the company's New York office. The company will carry a stock of all its lines in Boston and hopes in this manner to render its New England trade an improved service.

Proceedings of Technical Societies

The Illuminating Engineering Society

The December meeting of the New York Section was held on Thursday evening, the 14th, at which a paper was presented on The Conservation of Vision, by Dr. Ellice M. Alger. The author treated briefly, but with remarkable thoroughness and precision, considering the limits of such a paper, all of the causes of impaired vision with some few rare exceptions. As a result of such treatment only a comparatively small portion of the paper was devoted to the matter of illumination and its effect upon the eye; but this portion is straight to the point:

"People must be taught not only the amount of work they can do without overstrain, but the intervals at which a short rest will increase their real efficiency. They must learn something, too, about the conditions under which they can work to best advantage. Proper artificial lighting, for instance, is signally important. The general impression seems to be that that room is best lighted which is most lighted, and that lighting like banking should be centralized as much as possible. This is a great mistake. Too intense a light decomposes the visual purple in the retina faster than it can be replaced and leaves a condition of retinal exhaustion. Likewise it compels a constant extreme muscular contraction of the pupil in the effort to exclude the light, which is both fatiguing and painful. Most of our buildings, both public and private, are glaring examples of extravagant and inefficient lighting, extravagant because of the waste of light and inefficient because they are not comfortable even to sit in. The problem of lighting the factory or the school room where the eyes are to be used for continuous close work is still more complicated. Not only is the amount of light to be carefully considered, but it must be correctly arranged. It is easy enough to arrange the details so that one workman or student shall have sufficient light without any of it either shining directly into his eyes or being reflected into them, but every additional worker makes the problem more difficult. With the many modern methods of commercial lighting by gas and electricity the composition of light as well as its intensity has become important. In the days of our forefathers with their candle light and student lamps the problem was simply one of quantity, the quality being notably soft and pleasant. But our modern lights, whether gas or electric, are often so intense as to be extremely fatiguing. They also contain many more of the violet and ultra-violet rays of the spectrum which are useful to us in the so-called light therapy and in radiography, but are certainly unsuitable for illuminating purposes. There seems to be no question that lights which are, in sufficient volume, capable of tanning and sunburning the skin may be responsible for a large part of the asthenopia which is so prevalent to-day. Furthermore, their effects on the deeper structures of the eye are suspected of being still more serious. The refractive media of the eyes undoubtedly absorb most, if not all the ultra-violet rays, so that the retina suffers little harm; but it is quite possible that this continued process of absorption may result in those little understood changes in the lens which are called cataract. It is a certainty that stokers, glassblowers and the like, who are continually exposed to very intense light and heat have an enormously increased liability to cataract.

"There seems to be no question that illumination made up chiefly of the red and yellow rays of the spectrum is the best for visual purposes, and the problem of securing a light which shall allow the maximum of efficiency and comfort and convenience is one for the illuminating engineer rather than the physician. But it cannot be too strongly emphasized that this is no mere academic question, but that its solution means not only comfort, but dollars and cents to every one who works by artificial light or has others working for him."

The paper, however, is an admirable summary of an important subject upon which illuminating engineers should have some general information. The paper was discussed by a number of prominent oculists who were guests at the meeting. One of these innocently exploded a bomb by

giving an unqualified indorsement of indirect lighting, which he stated he was using in his own residence and offices.

The regular monthly meeting of the Philadelphia Section of the Illuminating Engineering Society was held in the Assembly Hall of the Philadelphia Electric Building, 1000 Chestnut street, on Friday, December 15. The dinner which preceded the meeting was held at Mosebach's Restaurant, the attendance being forty-eight members and guests. After the dinner, adjournment to the lecture hall was in order, and an interesting exhibition of illuminating appliances for use by the physician and surgeon were examined, and a number of manufacturers of these novel contrivances demonstrated them later in the evening.

The meeting was called to order at 8 p.m. by Mr. Joseph D. Israel, chairman, one hundred and thirty-nine members and visitors being present. Mr. Israel introduced Dr. W. M. L. Coplin, medical director, Jefferson Hospital, and professor of pathology, Jefferson Medical College, who spoke on Institutional Lighting, with special reference to hospitals. Dr. Coplin has made a thorough study of the problem of correct and efficient illumination, especially of wards and operating rooms in hospitals, both here and abroad, and a great many new ideas in regard to what is required in hospital lighting were obtained from him. The paper was discussed by Dr. William Spitzka, Prof. Geo. Hoadley of Swarthmore College; Mr. C. B. Regard, Mr. C. O. Bond, Mr. F. N. Morton, Mr. G. B. Muth and others.

The annual meeting of the society will be held at the Machinery Club, 50 Church street, New York, on Friday evening, January 12, at 6.30 o'clock. The programme of the evening will be preceded by a dinner. The Committee of Arrangements announces its intention of making this meeting interesting, and to prevent it from generating into merely a discussion of the society's business.

Association of Railway Electrical Engineers

At the fourth annual convention of this association held in Chicago, November 6 to 10, the following papers and reports relating to illuminating engineering were presented:

Report of the Committee on Illumination. This is an unusually comprehensive report, giving a digest of the entire subject of illumination as applied to railway cars. The subjects treated are Visual Apparatus, Glare, Terms and Units, Calculation of Illumination, Railroad Station Lighting, and Incandescent Lamps.

The subject of Railroad Station Lighting is treated at length under ten different sub-headings, and the incandescent lamp comes in for an equally complete discussion.

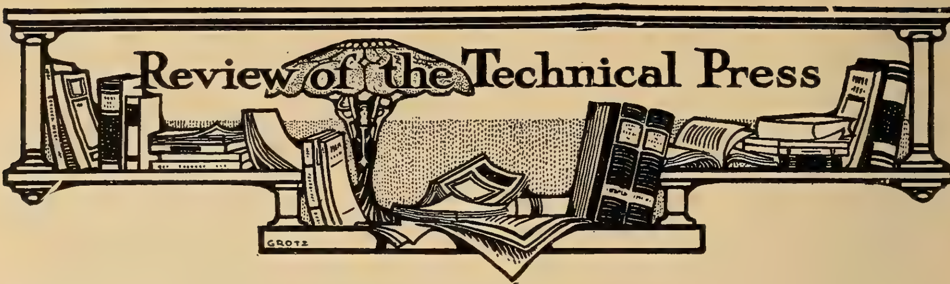
The report shows careful work on the part of the committee, and furnishes a good basis for the work of the railway illuminating engineer.

The report of the Committee on Improvements contains a section on lamps, shades, and fixtures, in which the most recent devices put upon the market are described, and their various points of merit given.

A paper on the Light for Safety was presented by Mr. F. R. Fortune. This is a brief discussion of the peculiar advantages of the mercury vapor lamp for the illumination of railway shops, freight houses, and similar purposes. Particular stress is laid on the increase in visual acuity afforded by the light from this source, the results of recent investigations on this subject being quoted.

American Society of Mechanical Engineers

At a recent meeting of the Society in New York, Mr. Frank W. Reynolds presented a paper on the illumination of textile mills. The writer states that electric lighting is now the general rule, although there are still a considerable number of mills using gas, and a few the old oil lamp. Where color values are not essential, the Cooper Hewitt Lamp has given good satisfaction. It has been found especially serviceable in machine shops. In cotton mills the operatives generally prefer local lighting, but the difficulties of securing good illumination of this kind are many, including cross shadows, dazzling light, and a background so dark as to increase the liability to accidents.



American Items

New Books

Illumination—Its Distribution and Measurement, by Alexander Pelham Trotter. 274 pp. Illustrated. Cloth. Macmillan & Co., New York. Price, $2.75 net.

Among the pioneers who blazed the trail of illuminating engineering before the definite work of mapping the territory was begun no one rendered more valuable services than Mr. A. P. Trotter. With Prof. Andre Blondel, who laid out the comprehensive and practical system of photometric nomenclature that has now become generally used, these two scientists put the measurement of light and the mathematical theory of its distribution upon a basis which entitled it to be considered among the exact sciences, and therefore a proper subject for treatment as an engineering problem. They may justly be called the forefathers of illuminating engineering; for, while they did not give the subject of the utilization of light this comprehensive title, their work was the immediate predecessor of the definite institution of illuminating engineering as a separate branch of applied science.

In the preface of his book, Mr. Trotter quotes an opinion expressed by Count Rumford in 1789, which will be read with interest by those who imagine that the importance of the subject is a discovery of yesterday:

"The art of illumination, although it is undoubtedly one of the most useful that has been invented by man, and contributes perhaps more than any other to his comfort and convenience in all countries and in every class of society, has not even been considered as an art; for the technical terms have not been invented which are indispensably necessary in order to render it possible to treat of it in a clear and satisfactory manner."

The author then gives, in a single paragraph, the origin and purpose of his book:

"One hundred and three years later, on May 10, 1892, a paper, of which the present volume is an expansion, was read before the Institution of Civil Engineers, was awarded a Telford Medal and a Telford Premium, and was published in Volume CX of the Proceedings of the institution. The subject still continued to attract little attention, and after sixteen years, at the invitation of Mr. Leon Gaster and with the permission of the Council of the Institution of Civil Engineers, the paper was rewritten and appeared in *The Illuminating Engineer* [London]. It has now been revised and extended, and is offered, not as a complete treatise, but as a record of the work of others and of my own investigations in evening hours, scant holidays and spare moments."

The book contains twelve chapters and an appendix, the subject being treated under the following headings: Units and Standards of Candle-Power; Illumination and Derived Units; The Distribution of Illumination; Distribution of Illumination over a Plane; Photometers; Accessory Apparatus; Distribution of Light from a Source; The Photometry of Colored Lights; Errors; The Measurement of Illumination; Practical Examples of Measurements of Illumination; Dioptric Distribution and Diffusion of Light.

The book has been written for the technically trained engineer, free use being made of higher mathematics, though only so far as algebra and trigonometry. As the author states, the discussions have been strictly limited to the subjects indicated

by the title, and in this field it is the most comprehensive, exact and clearly written treatise that has yet appeared. Mr. Trotter is one of the theoretical scientists who has the happy faculty, not only of distinguishing between what is purely theoretical and what is practical, but also the even rarer quality of elucidating the more abstruse theories by the use of exceptionally clear, simple and attractive language. His books and scientific papers are thoroughly readable. The illuminating engineering profession is to be congratulated upon the appearance of a work in its special field possessing all of the qualities of a masterpiece of scientific writing.

Arc Lamps and Accessory Apparatus, by J. H. Johnson, A.M.I.E.E. Pocket Size. 132 pp. Illustrated. Flexible Cloth. D. Van Nostrand Company, New York. Price, 75 cents net.

This little book professes to be a "primer written to enable electrical contractors, wiremen and engineers in general to decide upon the correct type of arc lamp to adopt for some particular purpose." Simple descriptions are given of the principle of construction of the different types of arc lamps now in commercial use, together with illumination curves, data in regard to cost of maintenance and general information useful to those who have the installation of such lamps. It is clearly written, and should furnish a very convenient pocket manual on this subject.

Subject List of Works on Peat, Destructive Distillation, Artificial Lighting, Mineral Oils and Waxes, Gaslighting, and Acetylene in the Library of the Patent Office, *London;* Price 6d.

This list gives a number of books, papers, and publications dealing with the various phases of artificial lighting, and will be useful to those who wish a complete bibliography of the subject.

Noble Indirect Illumination of a Large Dining Room from Floor Pedestals; *Electrical World,* November 25.

Portable Platform for Cleaning Chicago Boulevard Lamps; *Electrical World,* November 25.

Unusual Lighting Feature of a Small Milwaukee Show House; *Electrical World,* December 2.

Recent Street Lighting Developments in Pueblo, Mexico, and Vicinity, by Roscoe Scott; *Electrical World,* December 2.

Uniform Design of Street Lighting Standards; *Electrical World,* December 16.

Application of Diffusion to Eliminate Glare; *Electrical World,* December 16.

Decorative Lighting at Louisville; *Electrical World,* December 16.

Plain Talks on Illumination No. IV; *Electrocraft,* December.

Show Window Lighting—An Interesting Substitution, by J. J. Murphy; *Electrocraft,* December.

A Case of Compelling Co-operation, by T. P. Pinckard; *Selling Electricity,* December.

Principles of Illuminating Engineering, by A. G. Rakestraw; *Southern Electrician,* December.

Indirect Illumination Compared with Direct Illumination, by B. L. Benson; *Southern Electrician,* December.

Train Lighting Instruction Car on the Pennsylvania; *Railway Electrical Engineer,* December.

Will It Flicker? by G. S. Merrill; *Central Station,* December.

Glass Reflectors in Exterior Lighting; *Central Station,* December.

Green Bay's Brilliant Lighting; *Electric City,* December.

Arc Lighting, by C. P. Steinmetz; *General Electric Review,* December.

The Electric Arc and Lighting by Arcs, by Elihu Thomson; *General Electric Review,* December.

THE DESIGN OF LUMINOUS ARC LAMPS, by C. A. B. Halvorson, Jr.; *General Electric Review,* December.

THE COMPOSITION AND PREPARATION OF ELECTRODES FOR LUMINOUS ARC LAMPS, by E. R. Berry; *General Electric Review,* December.

RECENT DEVELOPMENTS IN LUMINOUS ARC HEADLIGHTS, by P. S. Bailey; *General Electric Review,* December.

FLAME ARC LAMPS, by S. H. Blake; *General Electric Review,* December.

ARC LIGHTS ON THE AMBROSE CHANNEL LIGHTSHIP, by H. V. Allen; *General Electric Review,* December.

ARC LAMP MANUFACTURE, A DESCRIPTION OF THE NEW ARC LAMP FACTORY AT LYNN, by W. G. Mitchell; *General Electric Review,* December.

INTENSIFIED ARC LIGHTING IN THE STORE OF BONWIT, TELLER & CO., NEW YORK, by W. D'A. Ryan; *General Electric Review,* December.

THE EMERGENCY LIGHTING OF THE RUINS OF AUSTIN, PA., by C. F. Barton; *General Electric Review,* December.

THE THEORY OF THE MERCURY ARC RECTIFIER, by W. R. Whitney; *General Electric Review,* December.

CONSTANT CURRENT MERCURY ARC RECTIFIER, by C. M. Green; *General Electric Review,* December.

THE STATION OPERATOR, THE LUMINOUS ARC LAMP AND THE SERIES MERCURY ARC RECTIFIER, by W. E. Carpenter; *General Electric Review,* December.

CONSTANT CURRENT TRANSFORMERS, by Howell H. Reeves; *General Electric Review,* December.

COLOR MATCHING BY ARTIFICIAL LIGHT, by R. B. Hussey; *General Electric Review,* December.

THE LIGHTING OF COURT HOUSE SQUARE, SCRANTON, PA.; *American Gas Light Journal,* November 27.

STORE WINDOW LIGHTING WITH ARC LAMPS, by E. S. Osbourne; *Progressive Age,* December 1.

THE THEORY OF INCANDESCENT LIGHT; *Progressive Age,* December 1.

THE SIGNIFICANCE OF ORIGINALITY IN MODERN GAS LIGHTING; *Progressive Age,* December 15.

RESDENCE LIGHTING CAMPAIGN, by Jas. P. Hanlan; *Progressive Age,* December 15.

STUDIES IN LUMINESCENCE—CHAPTER 16—THE FLUORESCENCE AND ABSORPTION OF CERTAIN URANYL SALTS, by Edw. L. Nichols and Ernest Merritt; *Physical Review,* November.

THE RECOVERY OF THE GILTAY SELENIUM CELL AND THE NATURE OF LIGHT ACTION IN SELENIUM, by F. C. Brown; *Physical Review,* November.

WHY DO CERTAIN LIVING FORMS PRODUCE LIGHT? by F. Alexander McDermott; *Popular Science Monthly,* December.

ILLUMINATION—COMPARISON OF LAMPS; *Data,* November.

HOW TO LIGHT THE WORK ROOM, by H. L. Estep; *System,* December.

CREATING A DEMAND FOR ILLUMINATION, by Frank B. Rae, Jr.; *Advertising and Selling,* December.

Editorials

THE PROPER REFLECTOR FOR A LAMP; *Electrocraft,* December.

WHERE ELECTRIC LIGHTING STOPS; *Electrocraft,* December.

THE FACTOR OF ILLUMINATION AND PRODUCING PROFITS; *Central Station,* December.

GAS FOR LIGHT MUST BE PUSHED; *Progressive Age,* December 15.

The
Illuminating Engineer

Vol. VI FEBRUARY, 1912 No. 12

ECONOMY

Economy is the best hated of all the virtues. It is the antithesis of all that human nature most desires—to live without thought for the morrow and heedless of the necessities of the day. It means renunciation at the best and grinding privation at the worst. Economy is a tolerable virtue only when it signifies a wise choice of evils; when the renunciation of one thing makes possible the acquisition of another that is more desirable.

Of all economies the wisest and most satisfactory is that which avoids the waste of human energy, whether physical, intellectual or moral. Such waste has no compensating return, but is an irretrievable and total loss. The man who works an entire day to accomplish that which under obtainable conditions he could accomplish in half a day has wasted a portion of that which is above all price—life.

Economy in human effort is the only saving which is a reward in itself, for it does not involve the renunciation of any desirable thing. To wantonly waste human effort is a conscious sin, which in human law constitutes crime. To knowingly require man to labor under conditions which require a greater amount of energy than necessary is a transgression of the moral law as well as of economics. In the last analysis the laws of economics and morals will always be found in perfect accord.

Poor or insufficient light is indefensible from every standpoint. By preventing human effort from achieving its full results it wastes human life, and by reducing the material results of human labor it impoverishes not only the laborer but all those who must purchase his products, which it necessarily increases in price.

The high cost of living is the question of the day and many have been the attempts to find the cause. Leaving aside all theorizing on tariffs, overproduction of gold and the other fetishes of the political economists, is it not evident that society has increased its desires more rapidly than its ability or willingness to produce the means of gratifying them? And that the remedy is simply to increase human efficiency until it shall overtake human desires and demands?

The cry for economy is heard in the land. Let us begin with the most vital of all economies, the saving of human energy; and to this end let us not overlook the fact that we work by sight; that we see by light.

Let us have more and better light.

E. L. Elliott.

Lighting the Largest Publishing House in America

How the Curtis Publishing Company Selected a Method of Illumination for Their Palatial New Building in Philadelphia

By G. H. Swanfeld

" Nothing succeeds like success " is a saying whose truth is rooted in the foundations of human nature. The successful man, whether in war or politics, in business or art, never lacks followers and adherents, all ready and anxious to give to him that hath; while the unsuccessful man is followed only by those willing to take away even that which he only seems to have.

Of the successful man society asks not only "*where* did he get it?" but "*how* did he get it?" The multitude who have not the virtue of originality are always eager to assume it, and to reap the results of the genius of others; and so it happens that society and business are largely a matter of following the methods and examples set by the few.

A publishing concern which reaches every month one in ten of the entire population of this country, and one in twenty every week, must be set down as one of the most gigantic business successes of all time. It is doubtful if the entire ministry of all the churches of all religions has so large an audience. The fact that this success, when measured in dollars of profit, runs into the millions annually, is also significant. The housing of this gigantic enterprise in the finest and largest privately owned printing establishment in this country, and probably in the world, is a logical sequence of this financial success.

Not only " how did he do it? " but " how is it done? "; how is a business of this proportion carried on? is a most instructive and, if rightly answered, valuable question. Manifestly it involves many different elements. We shall examine only one of them: the method of lighting by which the work of following the infinite details of such a business is carried out.

In the first place, the lighting system that was adopted is the result of careful and extended premeditation, and not, as in so many cases, a makeshift result of an afterthought. When the new building existed only in the minds of the officers of the company and the architect, the question of lighting was under consideration.

In order to reach a conclusion that should embody the most advanced ideas of those especially qualified to handle the subject, as well as the carefully formed opinions of those directly concerned with

FIG. 1.—INDIRECT LIGHTING FIXTURE USED BY THE CURTIS PUBLISHING COMPANY, PHILADELPHIA.

FIG. 2.—TYPICAL OFFICE ROOM, CURTIS PUBLISHING COMPANY.

its use, the matter was referred to a committee of five, consisting of the company's own engineer, two consulting engineers and two lay members of the organization. This committee also had the advice and assistance of a competent oculist and a prominent illuminating engineer. This committee conducted an elaborate series of experiments in order to determine the best method of illumination for the purpose. A room in the building then in use was selected for the purpose, and its dimensions and the general conditions were submitted to different manufacturers of lighting appliances. A number of installations were purchased by the company and installed under the direction of the representatives of their manufacturers, changes being made from time to time in accordance with these representatives, the object being to test every available system at its best. The most elaborate measurements of the resulting illumination and amount of electric current consumed were also made.

In order to determine the effect upon those using the light each system was given a two weeks' trial. After all the systems had been tried the operatives, who numbered some two hundred women and girls, were asked to give their individual opinions. The result was a unanimous vote for the indirect method of lighting—a very remarkable result when the opportunities for difference of opinion, aside from any positive knowledge on the subject, is considered.

The importance of light with reference to the welfare and efficiency of the operatives was fully appreciated, and the efforts of the company from the start were directed toward determining the best light rather than the cheapest; in fact, the cost was quite a secondary consideration.

The system of lighting known as the "indirect method" consists in reflecting

the light that would naturally be thrown below directly up to the ceiling, which is of a light color, whence it is again reflected in a diffused form throughout the room. The ceiling thus becomes the visible source of light and may be compared to the sky when the sun is hidden by thin clouds. The object of this method is to prevent the glare and dazzling effect which results from the ordinary use of lamps; it produces the same soft, diffused light that is characteristic of good daylight. The fact that we can see more easily and distinctly by daylight, even though the intensity of the light is not so great, than we can by direct artificial light is due to this quality of diffusion. This fact was demonstrated in the present case by a simple experiment conducted by an oculist who was among those consulted. The method of testing the ability of the eyes to see, as will be remembered by those who have been fitted with glasses, is to place a sheet of paper having meaningless words in different sized type upon it at a given distance, and then determining the conditions under which the smallest sized type can be read. In this case the experiment was varied by the oculist by having the subject determine the distance at which he could read the entire chart under different forms of

FIG. 3.—PRIVATE OFFICE, WITH INDIRECT LIGHTING.

FIG. 4.—ROOM USED FOR THE ILLUMINATING ENGINEERING TESTS.

illumination. The usual method of direct lighting with electric lamps and shades was found to require the shortest distance; a method known as "semi-indirect lighting" enabled the letters to be read at a somewhat greater distance, while the indirect method selected permitted the type to be read at twice the distance of the direct lighting. The intensities in each case were the same.

The particular arrangement of lamp, reflector and fixture used in this installation is shown in Fig. 1. It consists of a brass vase, or bowl, suspended from the ceiling by an appropriate construction and containing a special silvered reflector in which is placed a high power Mazda or tungsten lamp. The distribution of the units in one of the typical office rooms is shown in Fig. 2. The characteristic difference between this method and the ordinary arrangement of lamps with reflectors throwing the light downward is the absence of visible, bright spots of light; in fact, the conditions in this respect are exactly reversed, the light units showing as opaque or dark spots instead of brilliant and generally dazzling points. The photograph has exaggerated the difference in intensity of illumination on the ceiling. To the eye there is little difference between the lightest and darkest portions.

It will be noted that only one-half of the outlets are used. The reason for the extra outlets is to provide for the possibility of a subdivision of the room into smaller offices, in which case it would be practically impossible to partition in any manner so that the room would have one or more outlets, and so avoid additional wiring. A smaller room thus partitioned off is shown in Fig. 3.

For engineering purposes a room on the fifth floor of the building was chosen, 115 x 146½ ft., having a floor area of 16,848 sq. ft. A view of this room is shown in Fig. 4. Down the center of the room the ceiling is 12 ft. high. On either side of this the ceiling is 14 ft. high, with supporting beams 10 in. deep. There

are 158 fixtures, each containing a 250-watt tungsten lamp, requiring a total of 39,500 watts of current. The ceiling is of dark cream color, dull finish. When the installation was first put in the average intensity, measured with the illuminometer, was 6.9 foot-candles. This is equivalent to 3.39 watts per lumen effective and 2.34 watts per square foot.

After six months of continued use under regular operating conditions the average intensity was found to be 5.7 foot-candles, giving 4.1 watts per effective lumen. This measurement was taken without replacing burned out lamps or cleaning the reflectors.

The intensity of illumination provided is high and could undoubtedly be reduced considerably without interfering with the practical results. It has been proven both by theory and experiment that the eye works with its normal effort under a considerably lower intensity of illumination by the indirect method than by direct lighting, and the intensity in this instance is high even for the latter. It is safe to say that the intensity could be cut in half and still leave an entirely satisfactory illumination. The practical results of the installation have proven entirely satisfactory both to employer and employee.

As an interesting side-light on the problem the company states that the matron in charge of the Welfare Department has entirely ceased issuing headache powders to the operatives since they have been working under this light, whereas previously the demand for these powders was a frequent daily occurrence. This is a most interesting proof of the intimate relation between poor illumination, eye-strain, headache and other physical disorders and confirms the wisdom of the company's policy from the start in judging the value of a system of illumination by its effect upon those using it rather than upon the amount of luminant consumed. Electric current is cheaper in the long run than medicines.

The Latest Word in Electric Street Lighting

New Haven, Conn., Demonstrates the Success of the New Luminous Arc Lamp

Improvements and developments in lighting have followed one another so rapidly in the last half-dozen years that we are hardly safe in saying that we have the latest and best form of light for a particular purpose unless we have come hot-footed from the inventor or manufacturer. The electric light achieved its original success on the use of carbon as the light-giving substance, or radiant. This element, carbon, is in many respects the most wonderful of all the substances with which science deals. It is the material basis of all living forms, and in the course of its infinite combinations and associations runs the whole gamut between the most complex and variable to the most simple and unchangeable. It has the paradoxical property of being so readily combustible as to constitute almost the sum total of fuels, and also one of the most refractory of elements; of being a most common and unattractive substance which soils all that it touches, and also the most brilliant and generally prized of gems.

The first electric lamp that came into practical use was the arc which used rods of carbon as the immediate source of light, and the incandescent bulb which soon followed used a fine filament of carbon for the same purpose. Side by side these two carbon lamps have seen the electric light develop from a scientific curiosity to the most prominent luminary in general use. For something over thirty years carbon remained the only practical source of light electrically produced. Then suddenly its position was challenged; metals that were entirely unknown, except to the scientist, took its place in the incandescent lamp, and metallic oxides were substituted for the carbon electrodes of the arc lamp. To-day the tungsten incandescent lamp and the magnetite arc are the leaders in electric illumination.

The "magnetite arc" is so-called for

FIG. I.—A PROMINENT CORNER IN NEW HAVEN'S BUSINESS SECTION BY DAY.

FIG. 2.—THE SAME CORNER AT NIGHT LIGHTED BY THE NEW SYSTEM.

the reason that one of the electrodes—the one giving the light—consists of black oxide of iron, which, as a mineral, is known as magnetite. The non-luminous electrode is simply a short piece of thick copper rod. The advantage of this combination is in the greater amount of light produced with a given amount of current, thus making the lamp much more efficient than the carbon arc. The light is bluish-white in color, and when diffused with the proper glass, is practically the same color as daylight. The lamp also produces a considerably greater quantity of light than the ordinary carbon arc. These advantages find their most profitable application in the public lighting of the business sections of cities, and hence the magnetite arc has rapidly come into use for such purposes.

The form of the carbon arc lamp has become as familiar a sight as the old time lamp-post; there is the metal casing, the size of a small bucket, from which is suspended a glass globe about a foot in diameter, the lamp being attached to an overhead support. With the new and improved forms of electric lamps there has come a general desire to make the lamp-post decorative, as well as merely useful; there are now hundreds of installations in which the posts, or standards, are really works of art, which add to the appearance of the street by day as well as by night.

A few years ago a successful effort was made by one of the arc lamp manufacturers to use the top of the decorative post as a protecting casing for the mechanism of the lamp, so that the posts simply showed a large globe at the top. The successful introduction of the magnetite arc has placed the carbon arc at a disadvantage in new installations, and the manufacturers of this new type of lamp have now utilized the same method of construction.

The first installation of magnetite lamps and specially constructed decorative standards was made in New Haven, Conn. The first lighting up of this "White Way" system took place on the evening of December 15, and was made the occasion of a general celebration, which attracted the largest crowds ever seen on New Haven's streets in the evening. At the same time an electric sign setting forth the slogan of the city was unveiled. A prize had been offered for the best expression to be so used, and over fifteen hundred replies were received. The winning words were, "Old Elms, but New Ideas," which were submitted by Mrs. C. M. Savage. Prizes were also offered for the best decorated floats and automobiles, the judges consisting of a number of clergymen of the city.

FIG. 3.—THE NEW LAMP AND POST AS IT APPEARS IN USE.

This celebration, and the event which occasioned it, which is only one of many similar occasions throughout the country within the past two years, is worthy of consideration from the sociological standpoint; it is convincing evidence of a marked awakening of the citizens in regard to the material prosperity of their city, as well as interest in the "City Beautiful." Furthermore, the contrast between a general jollification by the people over the installation of a new street

lighting system, and the mutterings of dissatisfaction over street lighting contracts that existed a decade ago is in line with the general movement of uplift in politics and business that has arisen within that time.

A daylight view on one of the prominent corners covered by this installation is shown in Fig. 1 and a night view of the same in Fig. 2.

Fig. 3 shows the lamp-post and globe in detail.

AS THE NEW HAVEN *Morning Courier Journal* SEES IT.

Lighting the People's Savings Bank, Cedar Rapids, Iowa

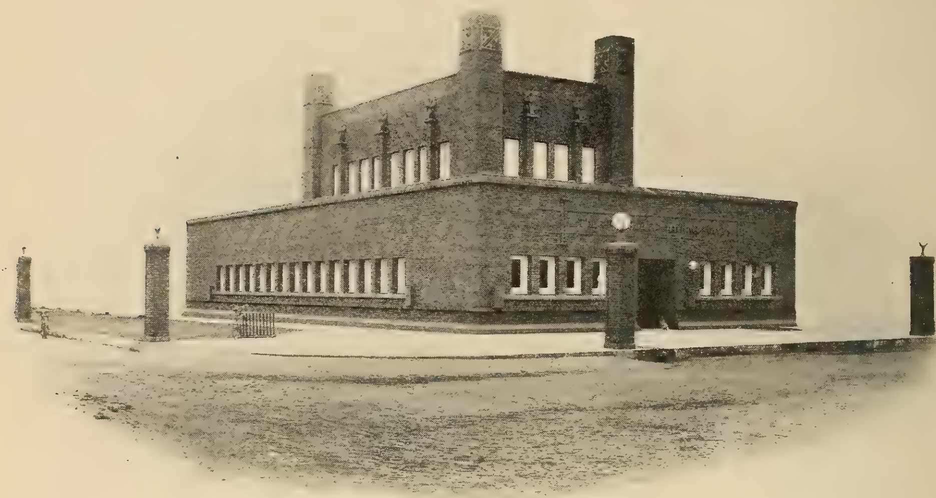
An Example of American Twentieth Century Ideas of Architecture and Illumination

By Louis H. Sullivan.

Probably no phase of the science and art of illumination, briefly called "illuminating engineering," has been so much discussed as its relation to the science and art of building, briefly called "architecture." The fact that a building can fulfill no purpose, either utilitarian or artistic, without the use of light sufficiently indicates the importance of the correlation of the two sciences. A complete discussion of an architectural work therefore necessitates an examination of the methods of supplying both natural and artificial light, and, conversely, the study of the lighting of a building demands a general analysis of its architectural motives and details.

We have on previous occasions lamented the fact that America has thus far produced little that is new, original and expressive of twentieth century conditions as they exist in this country, and has not only been contented with, but actually insisted on endless repetitions of the motives and structural ideas developed in other countries and in other ages that have little in common with the present. It is therefore highly gratifying to note any worthy exception to this rule. The building discussed in this instance is such an exception. It is remarkable not for its size or cost, but as the result of what we believe is the only logical procedure in architecture, and this logic could not be more tersely or clearly set forth than in Mr. Sullivan's own words.

The same general principles will also apply to illuminating engineering. We



THE PEOPLE'S SAVINGS BANK, CEDAR RAPIDS, IOWA.

particularly commend the description of this building and the views expressed to all who are seeking to unite the results of modern science with the highest esthetic ideals in the art of building.—The Editor.

General Description

EXTERIOR

The exterior treatment is of brick, with terra cotta trimmings. The brick used are Indiana shale wire cut, with a nap surface. The brick come from the kiln in about fourteen colors or shades. They are laid up promiscuously with ⅜-in. joints raked out ⅜ in. deep. The general effect is that of an antique Oriental rug. The terra cotta is given an average tone to match the brick and also a corresponding roughness of texture.

All frames and sash are painted white. The windows in the clearstory are filled with leaded opalescent glass of a superior quality. The lower windows are of polished plate.

The keynote of the design is found in the clearstory, which surmounts the public space below. It is cornered by four vent stacks, one of which contains the smoke pipe. The lower part houses the working departments, etc. The scheme of the design is to produce by the use of simple lines and plain surfaces a quiet, dignified effect, which will show to the best advantage the natural beauty of the material employed.

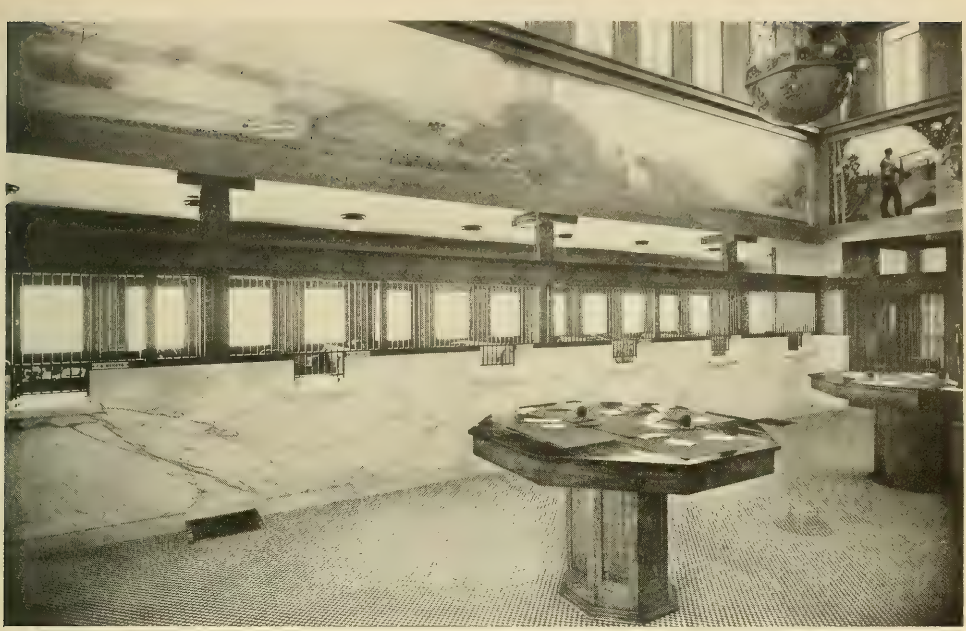
The exterior is thus a logical outcome of the plan, the building being designed from within, outward, the prime governing considerations being utilitarian—that is, an effort was made to secure a banking layout specially adapted to its class of business, and which should be, as nearly as possible, an automatically working machine.

INTERIOR

The high point of interest is the interior. It was designed, with all its adjuncts, strictly as a banking room. Its plan may be called "democratic," in that the prospect is open and the offices are in plain view and easily approached. This may be called the modern "human" element of the plan, as it tends to promote a feeling of ease, confidence and friendship between officers, employees and customers. The comfort of patrons is further cared for by rest rooms, etc., for men and women.

All parts are well supplied with daylight.

The general treatment of the interior is very rich, a well devised color scheme be-



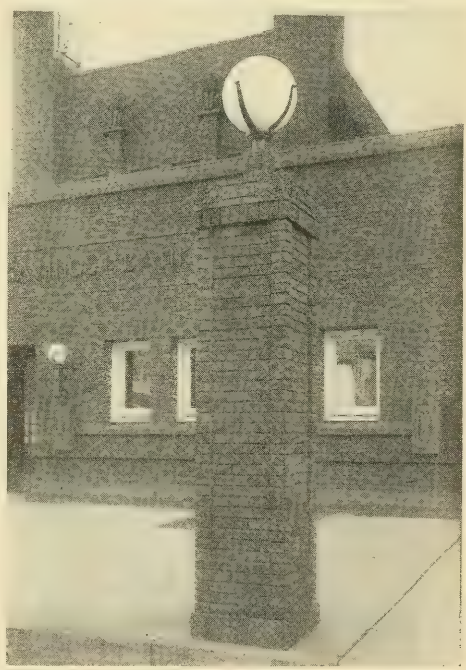
LOBBY, LOOKING EAST, SHOWING TELLERS' QUARTERS AND WORKING FORCE. MURAL PAINTING, "SPRING MORNING."

ing maintained throughout. The general effect is attractive and inviting, all repellant aspects of mystery, reserve, dullness and frigidity (so characteristic of the older banks) being carefully eliminated, and the social fact brought into prominence that banking is a function of society and not a secluded mystery apart from the people.

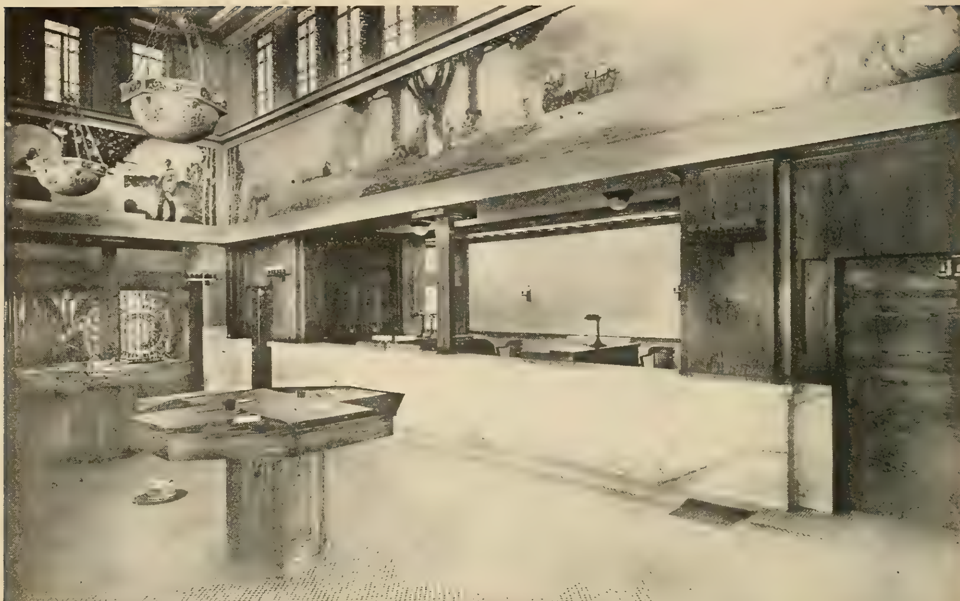
The materials used are of the best quality. The floor is of green and white encaustic tiles, 1 in. square. The marble of the counters is statuary veined Italian. All grill work is of copperplate, with verde antique finish. The woodwork is all of selected oak, stained to a walnut shell tone. All leaded glass is opalescent and is made part of the color scheme. The columns are of cast iron, richly decorated in many colors. The fixtures in tellers' quarters are all specially designed by the architect. Wire partitions and overhead work are not used.

The system of electric lighting is indirect for the main public hall and direct for the balance. The bowls of the indirects are treated in many colors; the remaining fixtures are mostly verde antique.

The color scheme reaches its climax in the four mural paintings on the lower walls of the clearstory. Only one of these



DETAIL OF STREET LAMP.



LOOKING WEST, SHOWING OFFICERS' QUARTERS. (CONSULTATION ROOMS SHOWN IN OAK.) MURAL PAINTING, "SUMMER MORN."

VIEW OF OFFICERS' QUARTERS, LOOKING INTO LOBBY.

is formal. It represents the relation of banking to labor. (Most of the bank's clients are of the working class.) It is painted in high color on a gold background. The three remaining paintings deal with agricultural scenes characteristic of Iowa, and symbolize not only the source of the wealth of the state, but the bank's dealings with the farmer.

The entire scheme, therefore, is a complete inversion of the traditional notion of what a bank should be, and as complete a statement of what this particular bank, with its special needs, ought to be and is.

Starting with a thoroughgoing search into and analysis of these special needs, and with unwavering logic following the *demands* of these special needs to a complete conclusion, has resulted in this case (as it might in the case of any other bank) in a highly specialized, unique and individual building.

The philosophy ever present throughout the plan and design of this structure is expressed in the formula, form follows function. This law is universal. It applies not only to things organic and inorganic, but to every phase of human thought and activity. And inasmuch as men create in the image of their thoughts the validity of their creations is subject to the acid test of this law. Supplemental to the above is the following—namely, *every problem contains and suggests its own solution*—which means that one is to seek and find the solution within the problem itself, under the general law above given. All our problems are modern and of ourselves; therefore all our solutions must be of our day and of ourselves—by and for ourselves.

THE WOMAN'S ROOM.

FIG. I.—GETTING OUT THE CROWDS. AN OPEN-AIR VAUDEVILLE PERFORMANCE.

The New Ornamental Cluster Lighting At Pasco, Wash.

Some Developments that Lewis and Clark Never Dreamed of

By R. J. Andrus.

Pasco is a little city of four thousand people, located in the famous irrigated Yakima Valley, near the junction of the Snake and Columbia rivers, in southeastern Washington. It is on the main line of the Northern Pacific and Seattle, Portland & Spokane railroads, being a division point for both roads.

The city owes its existence, primarily, to a heavy railroad and industrial payroll, supplemented in recent years by a rapidly increasing tributary farming district. Along agricultural lines dry farming of wheat, in addition to irrigation farming, is being rapidly extended.

The Pacific Power & Light Company furnishes electric light and power service, as well as operating the water works system at Pasco. The company is now operating approximately 600 miles of 66,000-volt three-phase transmission line in central and southern Washington and northern Oregon.

On December 23, 1911, the Mayor issued a proclamation designating that date for a municipal celebration. The purpose of this civic holiday was to publicly emphasize the completion of municipal improvements made during the year, the total amount of which has been approximately $600,000. Included in the municipal work has been extensive paving, construction of cement sidewalks, a $60,000 high school, a $40,000 city hall, sewer system, and ornamental cluster post lighting installation.

The afternoon of the civic holiday was given over to athletic events, open air vaudeville and similar entertainment. Fig. 1 gives an idea of the popularity of one of the vaudeville numbers. Two blocks on Lewis street, which is the main business street of the city, was roped off for the afternoon and evening carnival. In addition to the illumination of the cluster lighting posts throughout the length of these two blocks, festoons of red, white and blue incandescents were suspended across the street, between posts. Fig. 2 shows this installation. Flaming arcs suspended at the center of these two blocks and a searchlight covering the entire stretch of the carnival scene gave a great brilliancy of illumination.

During the evening Mayor Gray of Pasco, at the close of his address, opened a control switch at the speakers' stand, leaving the downtown business streets in darkness. When the switch was closed for the second time the new cluster post system and special decorative lighting was turned on for the first time. Addresses were made by President Eben White of the Commercial Club and the writer on behalf of the lighting company, as well as many prominent citizens of the city.

This installation covers ten and one-half blocks of the two principal business streets of the city. These streets lie at right angles, resulting in the district illuminated being in the shape of a huge "T."

The posts installed are of the three-light type, as used in the city of Seattle. Each post is equipped with three 60-watt 120-volt Mazda lamps, arranged on two circuits, the top lamp of each post being on a separate circuit from the two side lamps. The upper lamp of each post is equipped with a 16-in. globe, the side lamp globes being 14 in. in diameter. All of the globes are of Alba glass. The posts are installed four to a block and symmetrical on the two sides of the street, bringing the posts 130 ft. apart. As the blocks are 400 ft. in length, this places the posts at each street intersection 5 ft. in from the property line. This results in bringing eight posts around the street intersection, affording a very uniform and increased illumination at these points. The posts are fed on a 110-220-volt three-wire system, which in detail consists of three No. 10 rubber-covered wires, carried in ¾-inch black conduit, laid under the pavement gutter, between posts. The top lamp of each post being on one side of the three-wire circuit and the two side lamps of each post being on the other side of the three-wire system, the two sides of the street being balanced on three-wire secondary distribution. The conduit runs, controlling eight posts, are brought up to iron entrance switch boxes, located on the wooden poles of the company's distribution system. As all of our distribution is in the alleys, this brings the control boxes at the intersection of the street and alley. The neutral at the control boxes is non-fused, and there is no switch installed on the neutral control, the two circuits being closed on two single pole fused knife switches.

The cost of the system installed complete, with lamps, globes, controlling switches and boxes, was borne by the city and amounted to approximately $100 per post. The cost of operation and maintenance of system is paid for from the general municipal funds of the city. The installation cost was handled by the creation of a special improvement district and the

FIG. 2.—SPECIAL FESTOON ILLUMINATION FOR THE CARNIVAL SEASON. FIREWORKS AT LEFT.

FIG. 3.—THE NEW STREET ILLUMINATION AT NIGHT.

cost of installation was assessed against the property directly benefited.

The Pacific Power & Light Company has a five-year contract with the city at a rate of $30 per post per year, which covers current, renewals and patrol expense. This contract automatically renews itself for an additional five years at a rate of $26 per post per year, unless terminated by the city by written notice within 30 days of the expiration of the contract term. The contract can be renewed at the option of the city at the end of ten years for an additional term of ten years at a rate of $26 per post per year. All lamps on each post will burn from dusk until midnight every night in the year; the side lamps will be extinguished at midnight, the top lamp burning until dawn. This patrol service is handled for the company by a night messenger boy, who also turns out signs, outlines and flat rate window lighting installations. This patrol service costs the company $1 per switch box per month. In addition to patrol service, the company provides renewal of lamps and globes and gives the system a regular inspection on Saturday of each week. Upon this inspection lamps and broken globes are renewed and outer globes cleaned. The company is to paint each post once a year with a good waterproof paint. We expect this inspection service will keep the installation in perfect condition and encourage other flat rate business.

We have for some time been giving

FIG. 4.—A NEAR VIEW OF THE ORNAMENTAL POST.

these Saturday inspections on our flat rate signs, building outlines and window lighting.

The initial work of interesting the people of Pasco in a decorative street lighting system was begun last January. Descriptive literature was sent to all of the councilmen, members of the Commercial Club and business men of the city. We finally secured a contract for an installation of six posts at one of the hotels of the city, the expense of installation and operation being borne by the hotel management. As usual, the initial installation created a desire upon the part of all business men to have a similar system cover the downtown streets.

The writer has just been successful in interesting the Commercial Club and City Council of Pasco in the erection of a slogan sign. This sign will be erected at the Union Depot, where the cluster post lighting system begins.

" KEEP YOUR EYE ON PASCO " is the text of the slogan, the " eye " being animated, winking open and shut.

Bowling Alley Lighting

Some Interesting Comparisons of Old and New Methods

By R. F. PIERCE.

In seeking data on the lighting of bowling alleys, the engineer is forcibly struck with the fact that little agreement seems to prevail, even among practical bowlers, regarding the relative desirabilities of different distributions of illumination. All sorts of ideas are advanced, in many cases directly conflicting. This is probably due to the fact that different bowlers use different methods in " aiming " the ball. Bowling is somewhat analogous to shooting in this respect. Just as one man will aim at the object along the rib of the gun, while another will keep his eye on the object and disregard the rib, sometimes even shooting from the hip, leaving the proper position of the gun to his trained muscles and nerves, so some bowlers prefer to " set the ball to the alley " by observing the curve of its path, while others seem to allow for the curvature of the alley instinctively after a few trials.

The former naturally require a more brightly lighted alley, while the latter emphasize the importance of a high degree of illumination on the pin board.

On one point, however, all are agreed —that glare should be reduced as far as possible.

As the surface of the alley is highly polished, the use of angle reflectors is an absolute necessity.

The problem then becomes largely a matter of apportioning the available light with reference to the different portions of the alley and the elimination of glare from wall surfaces. The latter, though comparatively small, may be sufficient to distract the eye and is thus undesirable. The apportioning of light above and below the horizontal also requires attention. While in former practice it has quite generally been believed that the surrounding of a lighted area by one of entire darkness enabled a lower intensity of illumination to suffice for satisfactory vision, this contention has by no means been satisfactorily demonstrated, and, even if true to a certain extent, may be outweighed by the eye-fatigue experienced under the wide and frequent accommodation required by the excessive contrast.

It was deemed desirable to obtain a comparison between an alley designed with the above requirements in view, and one of the well-known sort where the lighting is accomplished by enameled steel hoods of pyramidal form, designed for extensive distribution in the plane parallel to the alley length, and intensive distribution in a plane at right angles thereto.

Fig. 1 shows the original appearance of the illuminated alleys. While the slight extension of the lower edge of the hood would have eliminated the direct glare of the lamps, it would have not

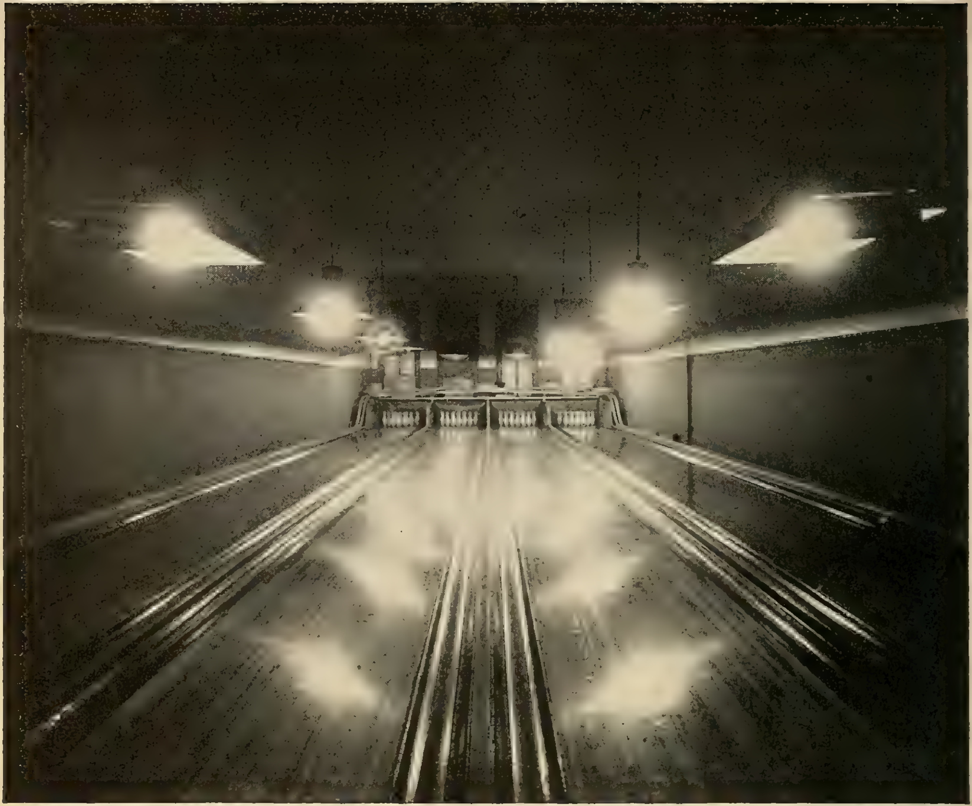


FIG. I.—OLD METHOD OF LIGHTING. LAMPS IN LARGE HOODS.

FIG. 2.—ONE-HALF OF ABOVE ROOM LIGHTED BY NEW METHOD. NOTE THE ABSENCE OF GLARE ON THE ALLEY.

decreased in the least the excessive and obnoxious glare from the alley, which is plainly shown. It will also be noted that in spite of the two mantles over each pin board, the pins are not especially well seen. After remodeling one-half of the installation in accordance with the principles set forth above, the photograph reproduced in Fig. 2 was taken. In both cases the lens of the camera was placed in the position of the eye of a man of average height, stooping to deliver the ball. The better illumination of the pins on the alleys lighted by the properly designed system is plain.

The superior illumination of the alley as well is not properly shown as the excessive glare from alleys 3 and 4 outweighed, on the photographic plate, the greater but more uniform illumination on alleys 1 and 2.

Figs. 3 and 4 show respectively the illumination on 1 and 2 by the properly designed installation only, and that on two alleys on the floor above corresponding to 3 and 4.

These were selected on account of the fact that alleys 3 and 4 were in use at the time the photographs were taken. The lighting systems were exactly identical.

The superior illumination of the pin lights under the new system is again plainly shown, and the same comments hold regarding the lighting of the alley floor as above. Here again the excessive glare from the hooded lamps outweighed on the photographic plate the much brighter but more uniform illumination of alleys 1 and 2.

One would presume that shadows might be apparent from the pins on alleys 1 and 2, on account of the small reflectors used at the pin board, in contrast to the wide ones on alleys 3 and 4. No such shadows were visible, however.

Especial pains were taken to ascertain the opinions of bowlers regarding the new installation without making direct in-

FIG. 3.—ALLEY SHOWN IN FIG. 1, WITH REMODELLED LIGHTING.

FIG. 4.—ANOTHER ALLEY LIGHTED BY OLD METHOD.

FIG. 5.—FLOOR PLAN OF TYPICAL ALLEY SHOWING ARRANGEMENT OF THE NEW LIGHTING AND THE TEST STATIONS.

quiries. It was observed that almost invariably alleys 1 and 2 were, whenever possible, selected by players in preference to other alleys. Frequent comments were made regarding the absence of shadows on the pin board and the cheerful appearance given by the illumination of side and end walls—evidently a welcome change.

A description of the installation follows:

Units marked A = reflex lamps with 20-degree aluminum reflectors, 5 ft. 4 in. above floor to mantle centers.

Units marked B = reflex lamps with 30-degree enameled steel reflectors, 8 ft. above floor to mantle centers.

Units marked C = two inverted mantles in steel hoods.

Units marked D = one inverted mantle in steel hood.

The alleys were of regulation size, and Fig. 5, which is drawn to scale, shows the spacing and arrangement of the lamps perfectly.

All illumination measurements were for the horizontal component and were made in the middle of the alley with a Sharp-Millar portable photometer placed upon the floor of the alley.

As the results were mainly required for comparative purposes, greater refinements, which would have taken more time than was available, were not attempted.

Readings were taken at 12 stations in each alley, and the photometer was calibrated immediately before use and found correct.

Curve "1 & 2" shows the illumination down the middle of alleys 1 and 2 from lamps A and B alone, while curve "3 & 4" (dotted) gives the illumination down the middle of alleys 3 and 4 from units C and D only.

Curves "3" and "4" (full line) show the illumination on these alleys from lamps A and B alone.

The lighting of the lamps is accomplished by a wall push button controlling filament igniters mounted on the burners. The gas supply is controlled by individual magnet gas valves mounted above each lamp, and all controlled from one push button located near the push button controlling the ignition.

Lighting the Railroad President's Private Car

How He is Given Daylight Twenty-Four Hours a Day

By L. Schepmoes.

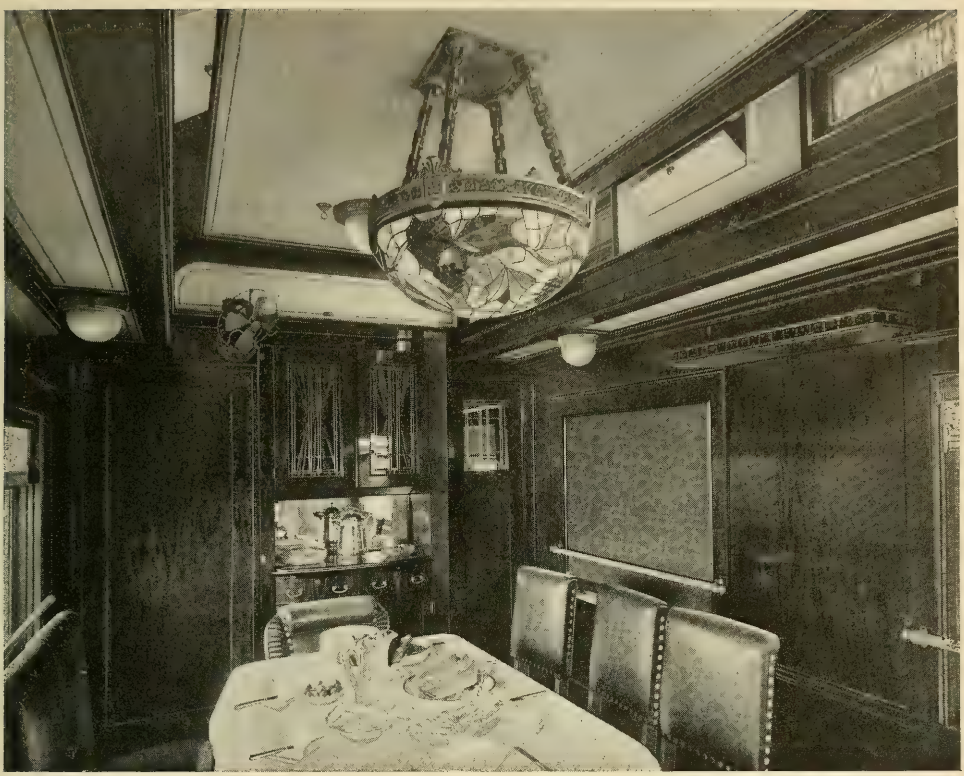
The adaptation of indirect lighting to railway cars has not been attempted until recently, and it is, therefore, interesting to be able to note the results obtained by this method of lighting on the first car so equipped. The private car of Mr. B. F. Yoakum, chairman of the Board of Directors of the 'Frisco Lines, using indirect lighting, was placed in service in November, 1911. This car was built at St. Charles, Mo., by the American Car & Foundry Company, and the lighting fixtures were designed and built by the Safety Car Heating & Lighting Company of New York.

It is obvious that the dimensions of a railway car do not make the most ideal conditions for indirect lighting. The low ceilings and the customary mahogany panels and trim in the car prevent the most ideal illuminating results. It will, however, be seen from the accompanying tables, showing the illumination obtained by this method of lighting on this car, that the results obtained are very satisfactory. The fixtures used were not distinctly of the indirect lighting type, although in one of the lamps no useful light passes through the glass bowl of the fixture. The interior views of the dining and observation rooms on this car, shown herewith, give a very good idea of the design of the fixtures used. In the dining room the bowl of the fixture is made of leaded glass. The glass is of such a density as to permit of sufficient illumination of the color design, but does not allow any useful light to pass through. The bowl is mounted to the metal band, which is supported from the ceiling by

cast bronze chains. The design of the fixture, of course, was governed to a considerable degree by the requirements of car service. Sufficient strength was necessary to not only support the band and bowl, but also to insure against violent thrust of the fixture resulting from sudden jolts of the car. It will be seen from the illustrations that the convergent arms or chains produce a pleasing effect, while sufficiently far apart at their base or ceiling to give ample strength. Diverging arms or solid chains would increase the strength, but their appearance would detract from the fixture. The fixture in the observation room is identical with that in the dining room, excepting the bowl. The bowl of this fixture is made of leaded glass of greater translucency than the glass used in the dining room bowl, in order that some useful direct illumination is available.

The arrangement of the lamps and reflectors in these fixtures is somewhat unusual. Mounted at regular intervals inside the bronze band are twelve porcelain receptacles, using tungsten lamps. The lamps are held in a horizontal position so that the maximum light is thrown on the ceiling directly and by reflection. The reflector usually consists of a polished nickel band located under the lamps and of sufficient width to intercept the maximum downward flux of light. The tip candle power of a tungsten lamp is very small, but is enough to throw sufficient light across the bowl to illuminate that portion of the glass diametrically opposite from the lamp. By this method of lighting the glass shadows are avoided and a surprisingly even distribution of light is obtained at every part of the bowl. It might be well to note that owing to the dimensions of the room it was found desirable to raise the tips of the three lamps on each side of the fixture toward the ends of the rooms. This was done in order to obtain a wider angle of incidence and reflection to redirect more light to the ends of the room. These fixtures are unusually

THE OBSERVATION ROOM. PRESIDENT YOAKUM'S PRIVATE CAR LIGHTED BY THE SEMI-INDIRECT METHOD.



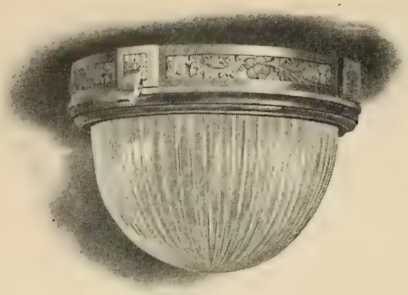
THE DINING ROOM, WITH BOTH DIRECT AND SEMI-INDIRECT LIGHTING FIXTURES.

large in comparison to what has been used heretofore in railway cars, and considered alone would be too large for the confined area of these rooms. This fact, however, was duly considered when designing the fixtures, and, since the finish of the rooms is severely plain, the fixtures become the single center in the composition or design of the rooms.

To appreciate more clearly the conditions governing the illumination of these two rooms, it might be well to say that the ceiling in the dining room is chalk white and the ceiling in the observation room ivory or cream white. The side walls, panels, etc., in both rooms are light mahogany. The carpet is dark green. The metal portion of the fixtures is finished in verde antique.

By comparing the illumination obtained from these fixtures in both rooms with the table of desirable illuminations compiled by Barrows, it will be seen the light is ample in both rooms. The illumination readings were made with a Sharp-Millar illuminometer, with the car furnishings exactly as used in service. The results of these readings, however, are not the only conclusive evidence of the good illumination. Casual observation as well as an extended observation of the light by the occupant of either of these rooms produces a pleasing effect. Where more illumination is required than that obtained by the indirect lighting fixtures, provision has been made for the use of four direct lighting lamps in each room, underneath the lower deck. The design of this fixture is illustrated in connection with this article and also a table lamp used in the observation room:

Illumination in foot-candles in observation room of 'Frisco private car. Readings made with a Sharp-Millar illuminometer on a horizontal plane 3 feet above the floor. Center fixture using twelve 15-watt tungsten lamps, the only source of light:



AUXILIARY DIRECT LIGHTING UNIT.

Station.	Foot Candles.
1	2.26
2	3.20
3	3.60
4	3.40
5	1.95
6	2.43
7	4.20
8	6.40
9	4.62
10	2.70

Average 3.28 foot candles.

Illumination in foot-candles in dining room of 'Frisco private car. Readings made with a Sharp-Millar illuminometer 3 feet above the floor on a horizontal plane. Location of stations shown on plan of room. Center fixture using twelve 15-watt tungsten lamps, the only source of light:

AUXILIARY TABLE UNIT.

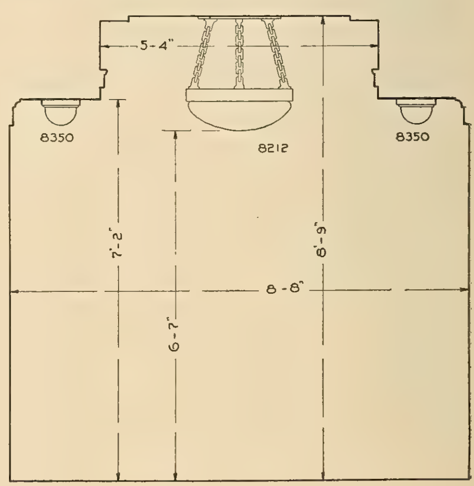
Station.	Foot Candles.
1	1.60
2	2.02
3	2.20
4	2.20
5	1.68
6	1.82
7	2.50
8	2.20
9	2.50
10	2.55

Average 2.06 foot candles.

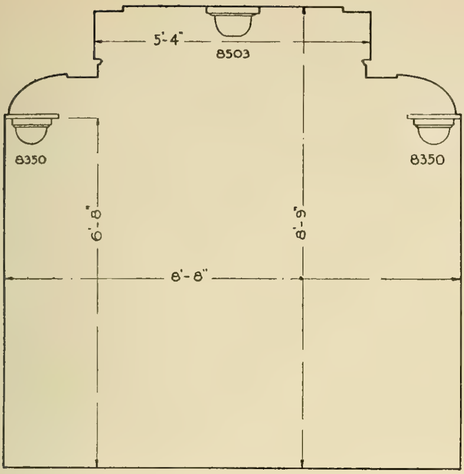
Illumination in foot-candles in dining room of 'Frisco private car. Readings made with a Sharp-Millar illuminometer on a horizontal plane 3 feet above the floor. Center fixture using twelve 25-watt tungsten lamps, the only source of light:

Station.	Foot Candles.
1	1.81
2	2.30
3	2.68
4	2.70
5	1.88
6	2.10
7	2.95
8	3.00
9	3.40
10	3.00

Average 2.48 foot candles.



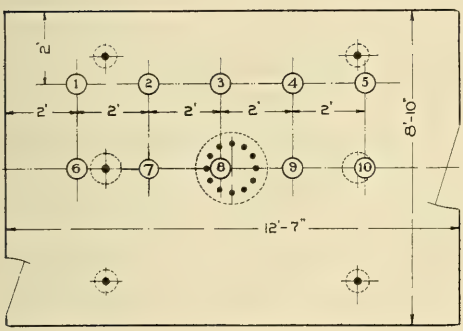
SECTION OF DINING ROOM, SHOWING HEIGHTS OF FIXTURES, CEILINGS, ETC.



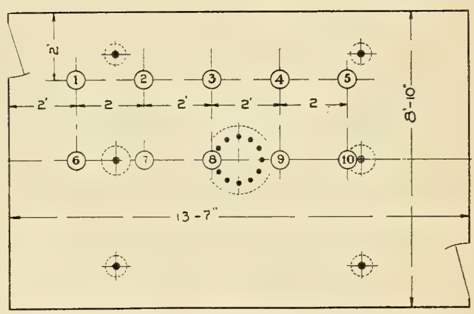
SECTION OF OBSERVATION ROOM, SHOWING HEIGHTS OF FIXTURES, CEILINGS, ETC.

Lighting Requirements in Foot Candles for Various Services as Compiled by Barrows.

Assembly rooms, corridors, public spaces	.5	to	1.5
Auditoriums, theaters	1	to	3
General illumination of residences	1	to	2
Reading: Good clear print	1	to	1.5
Reading: Newspaper print	2	to	2.5
Reading: Postal service	2	to	4
Churches	2	to	4
Library: General illumination	1	to	2
Library: Reading tables	3	to	4
Ballrooms	2	to	3
Desk lighting	2	to	5
General illumination of stores	2	to	5
Bookkeeping and clerical work	3	to	5
Clothing stores	4	to	7
Display of dark goods	5	to	10
Drafting, engraving	5	to	10
Street lighting by gas	0.05	to	0.25
Street lighting by electricity	0.05	to	0.60
Light from full moon	0.025	to	0.03



PLAN OF OBSERVATION ROOM, SHOWING LOCATION OF ILLUMINOMETER STATIONS.



PLAN OF DINING ROOM, SHOWING LOCATION OF ILLUMINOMETER STATIONS.

Illumination of the Louis XVI Dining Room Congress Hotel, Chicago

A Method of Lighting That is as Unique as It is Beautiful in Its Effect

By W. R. Moulton.

There is no class of building in this country that embodies so fully and magnificently the sumptuous luxury of modern times as the newer hotels. Our representative hotels may fitly be called the "palaces of democracy," and in their gigantic proportions, and refinement of luxurious equipment, as far surpass the dwellings of the kings, which were the palaces of former times, as the principles of democracy surpass those of the monarchy. All that the patience and genius of scientists, the inspiration of artists and artisans, the commerce of the four quarters of the globe and the limitless wealth of our wonderful country can unite for the comfort and gratification of the human body and mind are to be found here. Each new structure, or recasting of a former structure, presents the powerful motive to the designer and architect to surpass all previous efforts.

The redecoration and furnishing of the principal dining room of the Congress Hotel, Chicago, is one of the latest and most conspicuous results of such opportunities, and the most notable feature in this example is the method of artificial illumination. The dining room is 95 ft. long and 38 ft. wide, with a 20-ft. ceil-

FIG. I.—THE LOUIS XVI DINING ROOM, OTHERWISE KNOWN AS "THE COMPLEXION ROOM."

ing, and occupies one of the corners of the ground floor of the building, being thus lighted on two sides by windows, as shown in the illustration. The ceiling and wall decorations are in ivory and gold, with draperies of American Beauty red.

The artificial illumination is by the indirect method, but instead of the light-sources being suspended from the ceiling they are placed in large urns resting upon the floor, eight of which are symmetrically placed about the room. These urns are 7½ ft. high, and are handsomely sculptured, of a material closely simulating white marble. Within the bowl of each urn there are placed four large tungsten lamps fitted with special silvered reflectors, all being entirely concealed from the regular line of vision. The light is thus poured up against the ceiling, from whence it is softly diffused throughout the entire room. The softness of the light and the warm colors used in the decoration have caused the room to be called the "complexion room" by those who have observed its peculiarly pleasing effect in this respect; hence it may be readily conceived that it is in high favor with the ladies.

A word of explanation on this point may not be amiss. The two elements of a good complexion are a warm, healthy color of the skin and freedom from wrinkles. To secure the former it is essential that the light should have a sufficiently red tone to fully bring out the youthful glow; and to avoid exaggerating wrinkles the light must be free from sharp shadows, for wrinkles are seen only as shadows, which practically disappear under a perfectly diffused light.

A very happy afterthought in the decorative scheme, which has been since utilized, is the placing of a row of American Beauty roses around the outer edge of the bowl of the urn; thus the urns, which were somewhat cold and barren in appearance as originally installed, have been literally made to blossom like the rose, as well as to constitute living fountains of light.

The lighting of this room has attracted unusual and enthusiastic comment from architects and decorators, as well as from the many patrons of the hotel, and it is safe to predict that the idea so well executed in this case will bear further fruits.

The general conception of the scheme, as well as the design of the urns, is due to Marshall & Fox, the well-known Chicago architects, who have achieved distinction for the originality and beauty of their conceptions in other prominent buildings. The illuminating engineering work was done by the engineers of the National X-Ray Reflector Company, of Chicago.

The following technical data will interest those who contemplate similar installations:

The original specifications called for the use of four 250-watt Mazda tungsten lamps in each urn, but the hotel management, wishing to be sure of securing a brilliant as well as beautiful effect, substituted 400-watt tungsten lamps, which gives an average of illumination of approximately seven foot-candles at a consumption of 3.55 watts per square foot. This intensity, however, is probably too high, and after the novelty has worn off it is likely that lamps of the size intended will be used.

It is of interest to note, however, that even with these large lamps, and the resulting increase of current consumption, the chief engineer of the building states that it is 50 per cent. less than the amount of current previously used in lighting the room.

Economical Store Lighting

How One of New York's Oldest Mercantile Establishments Keeps Up With the Times in Lighting

By J. M. Coles

Economy as applied to the lighting of a store must not be mistakenly understood to refer only to the cost of the lamps and fixtures or the expense of operating them. This is the debit side of the account; on the credit side are the sales that result directly from the inviting and effective manner in which the goods are shown. Neither side of the account will be neglected by the wise merchant. The credit side being equal—*i. e.,* the quality of the illumination being the same—the installation that is more economical to operate and maintain will, of course, be chosen.

Under most conditions gas is the more economical illuminant from the point of operating cost. Its use, therefore, logically depends upon the quality of the illumination produced. In a general way quality of illumination in this case is its property of displaying the goods so that they will appear to their best advantage in every way. This requires that the light be of an agreeable color, always tending toward the warm tones rather than the cold—*i. e.,* toward the yellow and orange rather than the blue or green; that the distribution be such as to prevent sharp

FIG. 1.—A SECTION OF THE STORE, JOHN F. DANIELS' SONS & SONS, BROADWAY, NEW YORK, LIGHTED WITH HUMPHREY INVERTED GAS ARCS.

FIG. 2.—AN ENTICING ARRAY OF SHIRTWAISTS SHOWN UNDER MODERN GAS LIGHT IN ANOTHER DEPARTMENT OF THE SAME STORE.

shadows, and that the light-sources be so diffused as to prevent unpleasant glare in the eyes.

In these respects the modern gas arc has no superior. The color of the light is yellower than daylight, which gives it a somewhat softer and warmer effect, but is nearer to daylight in color than the other light-sources in common use. When the lamps are properly placed the distribution of light is such as to produce no dense shadows and yet give enough variation to afford the necessary light and shade to give what the artist calls " relief," and what we commonly understand by the expression " making objects stand out." When fitted with a light opalescent globe the visible light-source is not so bright that it cannot be looked at directly without dazzling the eye.

All of these points are well exemplified in the store shown in the photograph. The absence of dense shadows is particularly observable, and yet there is ample variation to bring out the goods in striking relief. Even the boxes on the lower shelves and the goods in the show cases are well illuminated. The general illumination is high enough to give a distinctly cheerful daylight effect to the entire room, and the absence of glare is shown by the absence of its photographic equivalent, " halation."

Fig. 2 shows a section in the shirtwaist department. If the goods here displayed do not secure purchasers it will not be the fault of the illumination, for surely daylight itself would require the most favorable conditions in order to produce as inviting an effect.

Two types of lamps are used in these cases known as three-mantle and five-mantle inverted arcs, and are one of the most efficient means of producing gas light that have yet been developed.

The Church Luminous

Cardinal Farley's Return Signalized by a Blaze of Electric Lamps

WIRING THE TOWERS OF ST. PATRICK'S FOR THE ILLUMINATION. PUZZLE: FIND THE WIREMAN.

Light in all ages has been the universal symbol of morality, knowledge and religion. The Christian church especially has made distinct use of the symbol, following the precedent set by the older Hebraic religious rites, of which it is the successor. More especially still has artificial lighting been symbolically used in that great division of the Christian church known as the Catholic. In the festivities expressing the enthusiasm and veneration of those of his faith in the return of their former beloved Archbishop, raised to the higher dignity of Cardinal Farley, it was natural and fitting that this ancient symbol should be utilized to the utmost of the possibilities afforded by modern science. The special illumination of St. Patrick's Cathedral, on Fifth Avenue, New York, was probably the most elaborate use of artificial light that has ever been made in connection with a church service, and it will in no wise detract from the sacredness of the occasion celebrated to describe the methods used to accomplish this wonderful result.

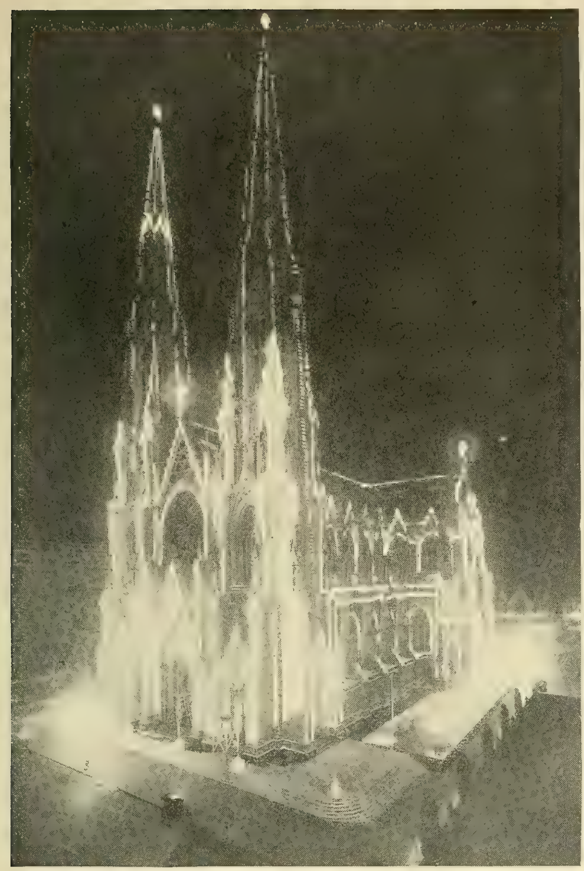
The exterior lighting was carried to the cross-surmounted tips of the two great spires, 340 ft. above the sidewalk. In carrying the wires to this dizzy height Steeplejack Merrill had to take a special three days' course in electric wiring. He predicts that in the future the main part of the steeplejack's work will be electric wiring, and he is going to be up with the times. He had three assistants to aid him in stringing the lights.

All of the arches, buttresses, windows, doors and all of the horizontal and vertical lines were outlined in electric lamps, while over the main entrance blazed in colored electric lights the coat-of-arms of the new Cardinal. There were 50,000 8 c.-p. lamps used on the cathedral, 20 miles of wire, and a mile of low tension feeder from the Edison sub-station at Fifty-third Street and Sixth Avenue to and around the cathedral.

The current consumed by the lamps was equal to 1200 h.-p. On the spires alone there were 11,000 lamps.

The lighting was planned by Charles R. Lamb and H. P. Poole, ecclesiastical architects, in consultation with officials of the New York Edison Company. Directly in charge of the work was J. P. Murray of the Bureau of Illuminating Engineering of the New York Edison Company. It was by far the most stupendous undertaking in exterior decorative illumination ever attempted.

In the interior 40-watt Mazda lamps of 32 c.-p. were used in place of the old-fashioned 16 c.-p. carbon



Copyright by the N. Y. Edison Co.
THE GLORIFIED CATHEDRAL.

ft. These fixtures are so high that this change was not especially noticeable as an architectural feature, although it altered greatly the lighting effect. Five of these chandeliers are in the nave and one in each of the transcepts. They are 130 ft. above the floor and so heavy that the combined strength of four men was required to hold the pulley ropes during the lowering operation.

At the top of each column in the body of the church is a cluster of lamps. As formerly arranged they were almost worthless as far as reading in the pews was concerned. Special tests were made to determine the best method of placing them so that the illumination would be thrown directly on the pews.

Additions were made in the sanctuary illumination to accentuate the beauty of the marble altar and reredos, but the altar itself was untouched. It is by means of lights concealed behind the piers that this part of the cathedral was illuminated,

lamps. The total installation contained 2,100 lamps. The seven great chandeliers, of 100 lamps, were lowered 20

while a chandelier was placed over the vault where the archbishops are buried.

An Ornamental Gas Lamp-post of Novel Design and Construction

The tendency to imitate is so strong in human nature as to furnish corroborative evidence to those who trace man's origin to simian ancestors. The most curious phase of this habit of imitation is the failure to discriminate between the good and the bad, for imitation follows the one quite as much as the other; in fact, one is often inclined to believe that we imitate faults more than we do virtues. Imitations of candles and torches are still much in vogue, although we would consider it an intolerable hardship to be obliged to depend upon those primitive light-sources for our illumination. Furthermore, they are frequently imitated by both the leading modern illuminants, gas and electricity, and, not content with this, gas has often imitated its later rival.

Gas has thus far made little headway in the great movement for ornamental street lighting, but so far as it has gone it

A DECORATIVE LAMP-POST OF UNIQUE DESIGN.

has in a general way followed the methods and general treatment given the electric lamp. It is, therefore, of special interest to note one positive and premeditated exception of this rule. This case comes from Sheboygan, Wis., and is directly due to Mr. Robert Young, the superintendent and treasurer of the local gas company. The post is shown in the illustration, but the story of how it came to be designed and the use to be made of it is best told in his own words:

"The post is made of cement, fine cinders, sawdust and 'expanded metal,' finished with a weather proof coating which gives it the appearance of polished white marble. It is equipped with four five-mantle white enameled standard outdoor inverted gas arcs, fitted with 'lucite' globes, which are in keeping with the general appearance of the post.

"I designed this post with the intention of placing it in front of our gas office as an advertisement, my idea being to produce something that would be distinctively a gas post which would leave no suspicion in the mind of the observer as to the nature of the source of light and demonstrate beyond the question of a doubt the superior brilliancy and effectiveness of gas for lighting.

"I could not find on the market any cast iron gas boulevard post equipped with single mantle lamps that did not resemble too closely electric designs to suit my purpose, and those on the market made for standard outdoor gas arcs did not appeal to me as being sufficiently attractive in the daytime. I therefore endeavored to make the concrete post ornamental and pleasing to the eye during daylight as well as at night.

"This post was not placed in front of our office, as it was our intention that it should be, and so did not fulfill the purpose for which it was designed. One of our merchants took a fancy to it and it was placed in front of his store at a cost to him for the post, without lamps, of $85.

"This post was not installed until shortly before the Christmas holidays, and we have not solicited further orders, as the severe weather at this season of the year would make installation prohibitive. We expect, however, to install some more next spring, but they will probably be designed for only one, or, perhaps, two, five-mantle standard outdoor arcs."

VIEW OF STOCK ROOM OF THE FORD MOTOR COMPANY, DETROIT, BY COOPER HEWITT ILLUMINATION.

Lighting the Stock Room

By G. R. Clover.

No one will question for a moment the necessity of providing an abundance of light of the best quality where regular work, and especially labor requiring close vision, is required. But there are some important departments in an industrial establishment that do not come under this head, and a mistaken idea of economy has very frequently resulted in the neglect to provide an illumination in these cases adequate to their needs. Perhaps foremost among such cases are the rooms in which raw materials and finished stock are kept. The time lost in looking for what is wanted in a dimly lighted room, or in walking about to turn switches on and off, will generally more than offset the cost of lighting such places continuously to a sufficient degree for the purpose.

Aside from this question of convenience, there is another almost equally important consideration, viz., the prevention of accidents. The comparative infrequency of accidental injury or death of employees is not a sufficient reason for not taking all possible precautions; fires are also comparatively infrequent, but the universal practice of protection against loss by fire insurance shows the wisdom of being prepared for the unexpected. Statistics conclusively prove that the large majority of industrial accidents occur during the dark months of the year, showing that artificial lighting has a direct influence upon their occurrence.

For the illumination of stock and storage rooms the Cooper Hewitt lamp is especially suitable. The fact that it runs

longer without attention than any other commercial light-source; that it is highly economical in current consumption; that the distribution of its light is such as to give a high degree of uniformity over large areas, and that the peculiar color quality of the rays permit of clear vision under much lower intensities than in the case of light of the ordinary quality, all apply to the special conditions of the problem.

The illustration shows a stock room of the Ford Motor Company, Detroit, Mich., lighted with Cooper Hewitt lamps. The room is 780 ft. long, 56 ft. wide, and so contains 43,680 sq. ft. Thirty-nine double-tube lamps are used, placed 40 ft. high. This illumination enables the room to be used when artificially lighted, with the same convenience and results as by daylight.

Lighting a High Class Haberdashery Store

An Artistic and Effective Use of Modern Gas Light

By L. F. Blyler.

Herr Professor Teufelsdrück, the imaginary author of the immortal Sartor Resartus, has left little to be said concerning the philosophy of clothes, but on the matter of selling these indispensables of civilization his work is lamentably weak. Even the vital question as to which is the more particular in determining the niceties of apparel, the male or female of the species, he has omitted altogether. The fact that in the evolution of western civilization the male has been shorn of all frills, laces and similar impedimenta, and has been reduced to inconspicuous monotony in outward appearance, is another phenomenon worthy of the consideration of the evolutionist.

The saying that " Fine feathers do not make fine birds " is literally false, and partially true only in its metaphorical application to the " featherless biped," for any evolutionist will tell you that the possession of gorgeous feathers by the male bird has a very important bearing on bird sociology, and the counterpart of this feathery display, which is monopolized by the female of the *genus homo*, has a more vital and far-reaching effect upon human society than is dreamed of in the philosophy of the superficial. In our so-called " western " civilization man, specifically speaking, has retained but a single vestige of his display of color in dress—to wit, his cravat. While his outer garments are confined to sombre grays and browns, or funereal black, custom still permits him this one dash of color. In this space of a few square inches he may revel in the most flaming scarlet or vivid blue, or any color of the rainbow, if he chooses. The facts show that he clings to this prerogative with tenacity and delight, as witness the markets where this particular element of clothing is predominantly displayed. The haberdashery store is man's little booth in " Vanity Fair."

After these many dazzling reflections upon man's relation to the universe, let us confine our attention for the moment to a question of more immediate consequence to the haberdasher—viz., the ways and means of lighting his wares so as to best further the ends of his business. The method used by one of the leading haberdashery stores of Minneapolis may serve as a useful example. This store, a night view of which is shown in the illustration, is 30 ft. wide and 125 ft. deep. The supply of natural light is therefore somewhat limited, hence the additional necessity of providing the best possible artificial illumination. The goods are disposed in glass showcases, as well as upon counters, which thus require a very completely diffused light for their proper display. Lastly, the class of goods handled and the customers catered to make it necessary that the store have a general artistic appearance.

All of these essential qualities have been satisfactorily produced in this case by the use of the most modern gas lighting appliances. There are twelve handsome chandeliers of classic design suspended

A HIGH CLASS HABERDASHERY ARTISTICALLY LIGHTED WITH GAS.

from the ceiling, so that the lamps are about 14 ft. from the floor. Each chandelier supports four reflex mantle gas burners, each fitted with a prismatic reflector. This lighting unit is further covered with an art glass shade of a brown tint to harmonize with the cabinet work of the store, which is of Circassian walnut.

This combination of prismatic glass reflector with an art glass shade accomplishes the two points sought for by illuminating engineers and users—viz., efficiency and artistic effect. The art glass shade is the only thing that shows, except almost immediately under the chandeliers, where one would not be likely to look up. The quality of the illumination is all that could be desired, being soft, steady and of an excellent color. It is not generally known that the best mantle gas burners give a light more clearly approaching daylight in its color value than any other artificial light-source in commercial use.

This installation demonstrates the claim made by the adherents of gas that it is capable of producing an illumination equal in artistic appearance, as well as quality of light, to any illuminant.

Side Lights

Some Interesting Notes Gathered from the General Lighting Field

Bad Lighting in Public Schools Is Taken Up By the Court.

New York City probably has more badly lighted school rooms than any other city in the world. The fact has already been noted in these pages that there are a large number of rooms in the schools in the congested districts where artificial light is required all day every school day in the year, and that the light furnished is of the poorest possible quality. One of the municipal court justices has now become interested in the subject, according to the *Evening World:*

Municipal Court Justice Benjamin Hoffman has appealed to the Board of Education to take steps to relieve what he considers one of the greatest menaces to the children of the East Side—ill lighting of rooms in which they have to study their lessons that their eyesight becomes defective.

According to Justice Hoffman, there has been a great increase in the number of children with defective sight during the past few years. Unless something is done, he says, a lamentable percentage of children of the poor will become almost totally blind.

"The public schools in my district," said the Justice to-day, "number among their pupils hundreds of children whose parents are too poor to buy eyeglasses, and who are rapidly going blind through studying in poorly lighted rooms at home and in almost as poorly lighted school rooms. Mr. Mandel, the principal of Public School No. 188, the largest in the world, with almost 5,000 pupils, has called my attention to this state of affairs and he and I are both trying to get the Board of Education to do something."

Justice Hoffman has taken steps to relieve conditions out of his own pocket. He has asked Mr. Mandel to send to him all children with poor eyesight, whose parents cannot afford glasses, and he will have them fitted at his own expense until the Board of Education or some philanthropic organization takes up the matter in a general way.

For the Illumination of State Highways.

The movement for good roads, which begun with the advent of the bicycle, and has been greatly fostered by its successor, the automobile, has now become an important political issue. State roads are now a regular institution in most States, and now that the advantage of the roads themselves has become appreciated, the desire has naturally arisen to have them lighted, a desire which is sure of fulfillment in the near future. The following interesting special to the New York *Globe* gives the situation in this State:

Senator White, of Schenectady, whose bill appropriating $25,000 for the experimental lighting of a strip of ten miles of the State highways, with a view to testing the feasibility of lighting the entire highway system, is now in the hands of the Senate Finance Committee, has been collecting some data as to the approximate cost involved in this project. It is estimated by experts at not more than $400,000, exclusive of power.

No estimates have been made yet as to the cost of furnishing the power. This would vary greatly, according to whether it was purchased from power companies along the route or drawn from the power supply that will be developed by the State's barge canal system.

Tungsten Lamps on Battle-Ships.

The one fault of the tungsten lamp on its first introduction was the brittleness of the filament, which rendered the lamp unsuitable for use where there was any shock or vibration. That this weakness has been entirely overcome is shown by a recent test of lamps on the United States battle-ship *Delaware*. After target practice with its 12-inch guns it was found that one-third to one-half of the carbon lamps were broken, while of the twelve drawn wire "Mazda" lamps, which were placed in the compartments immediately beneath the large guns where the shock was the greatest, none were noticeably affected. Perhaps we shall next hear that they have used the lamps for shells in the small-bore guns!

A Commercial Photometric Laboratory

How the Manufacturer is Developing the Scientific Side of Illumination

By W. J. Cady.

Most of the photometric laboratories in this country and abroad are interested principally in the photometry of lamps alone, whether gas or electric, and most photometric apparatus is specially designed for this purpose. The Holophane Company of Newark, Ohio, being interested in the testing of globes and reflectors and other illuminating appliances, therefore found it difficult to find a form of photometer which would meet all of its needs for reflector testing.

For lamp and reflector testing, where the lamp must be in a pendant position,

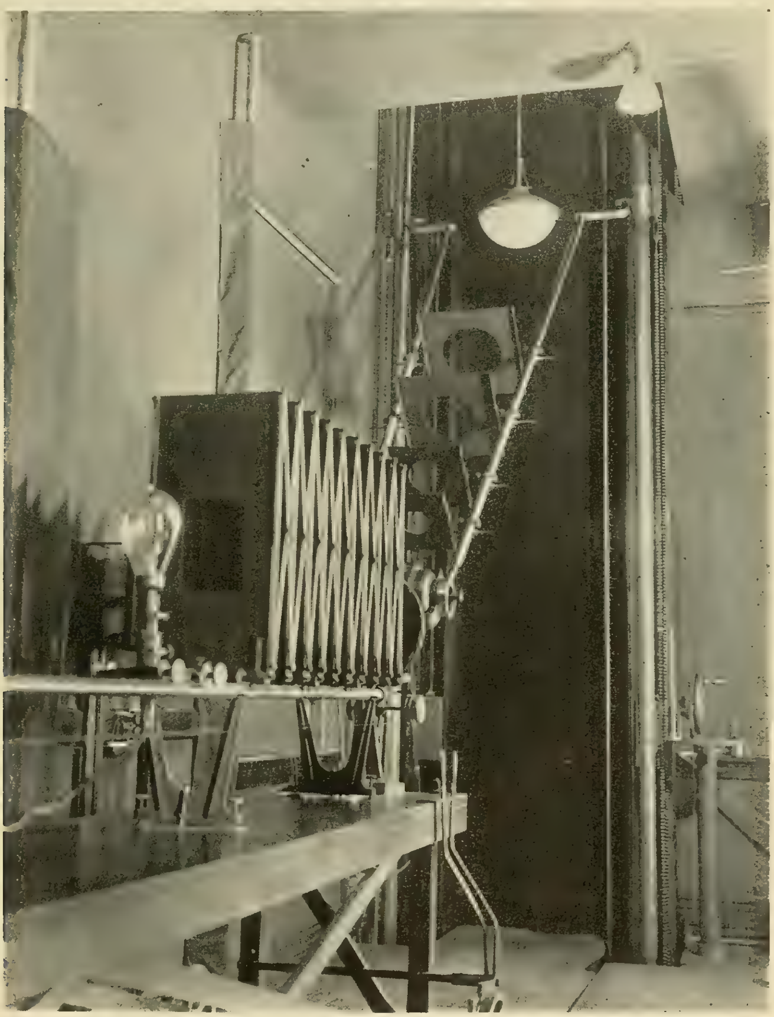


FIG. I.—END OF PHOTOMETER BENCH, SHOWING METHOD OF MAKING DIRECT ANGULAR READINGS.

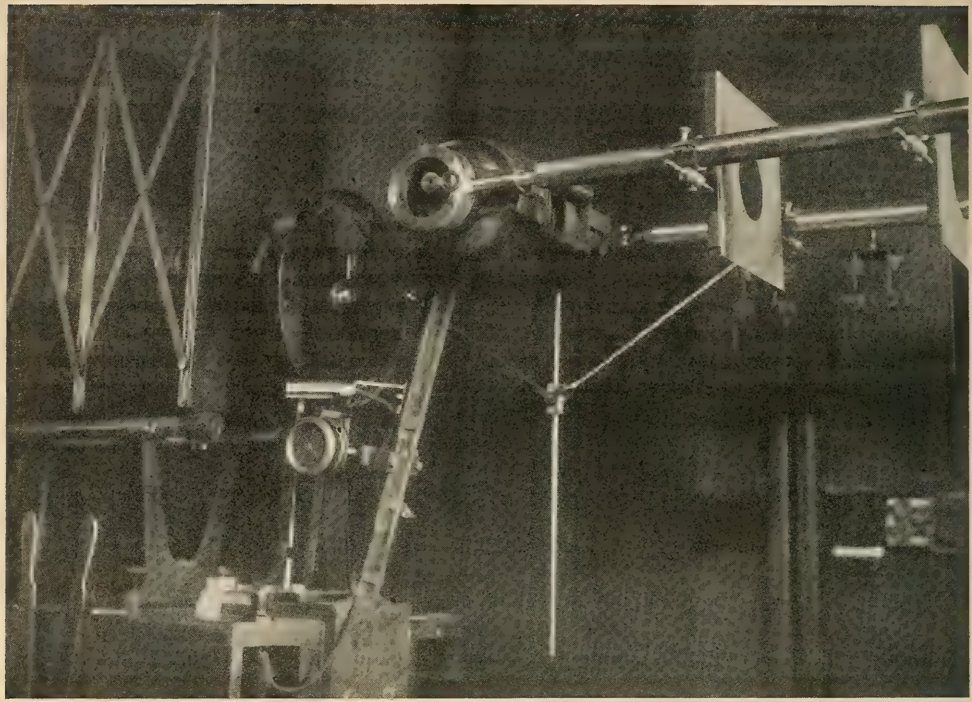


FIG. 2.—THE PHOTOMETRIC SCREEN.

quite a large photometer is necessary, and there are four general methods and kinds of apparatus available.

First, by the use of mirrors which rotate about the lamps to be tested, the test lamp and the photometer head may remain in a stationary position. This is of an advantage, because the apparatus to rotate the lamp may be made quite simple. It has its drawbacks, however, because of the mirorrs themselves, for it is a very difficult matter to obtain mirrors which will be absolutely uniform and have no variation in the coefficient of reflection. Even though the mirrors may be uniform at first, they will deteriorate rapidly, and this deterioration is not uniform. If, then, a reflector is to be tested, the mirror is practically calibrated for the coefficient of reflection over a very small area equal to the image of the standard lamp, and this coefficient is assumed to apply for the whole mirror. In the second place, the mirror acts selectively in its absorption, absorbing certain colors more than others. This is shown by the following figures given by Prof. E. L. Nichols:

Wave Length. Microns.	Efficiency of Reflection. Per cent.
0.43	82.7
0.49	90.1
0.59	91.6
0.64	93.6
0.75	95.0

It will be seen, therefore, that the difference in the coefficient of reflection from one end of the spectrum to the other may be as great as 12 per cent. If a light-source were to be tested which differed considerably in color from the standard lamp and the usual comparison method were used, this selective absorption of the mirrors might produce an error too large to be ignored, especially where two or three mirrors are used and the error is, therefore, magnified. These possible errors are recognized by photometrists, but still the mirror photometer is used because of its simplicity.

A second method requires the rotation of the photometer head about the lamp, but this means that the one who is reading the photometer must move in a circle about the lamp to be tested, and where a

test distance of 10 ft. is used this would require a small Ferris wheel.

The third method necessitates rotating the lamp about the photometer head. This requires a large beam or crane, the use of which is attended with numerous difficulties.

The fourth method is one in which the lamp is moved in a vertical line and the photometer head in a horizontal line. The apparatus for such testing is called a Dibdin radial photometer. This form of photometer was adopted by the Holophane Company as offering the least difficulties and sources of error.

Having decided upon the form of photometer to be used, a portion of the engineering building was specially designed and built for it. This was necessary, inasmuch as the photometer requires a shaft which extends through three stories. Fig. 1 gives a partial idea of the size of the photometer.

In order to keep the photometer head at a fixed distance from the lamp to be tested 10-ft. connecting rods are used, fastened to the lamp carriage and to the photometer head. As the photometer head is fastened to a table which travels on a track in the floor, when the lamp carriage is raised, it moves the table along the track toward the vertical line directly below the lamp. It is necessary that the photometer head should bisect the angle between the photometer screen, the test lamp and the comparison lamp, and a mechanical device is used which does this automatically. This is shown in Fig. 2, partially behind the photometer head. When it is desired to test a unit above the horizontal a trap door is opened in the floor and the unit is lowered into a pit in the basement.

One of the usual drawbacks to the Dibdin photometer is the screening system. This is more difficult to construct for this kind of photometer than for the usual bar photometer, because the light enters the photometer head at various angles. A special device was constructed which causes the opening on the test lamp side to revolve with the test lamp and keeps the opening on the comparison lamp side stationary. This is shown in Fig. 2.

A second ordinary cause of error in the Dibdin photometer is in the method of setting the angles. If the angles are measured off on the vertical line it is im-

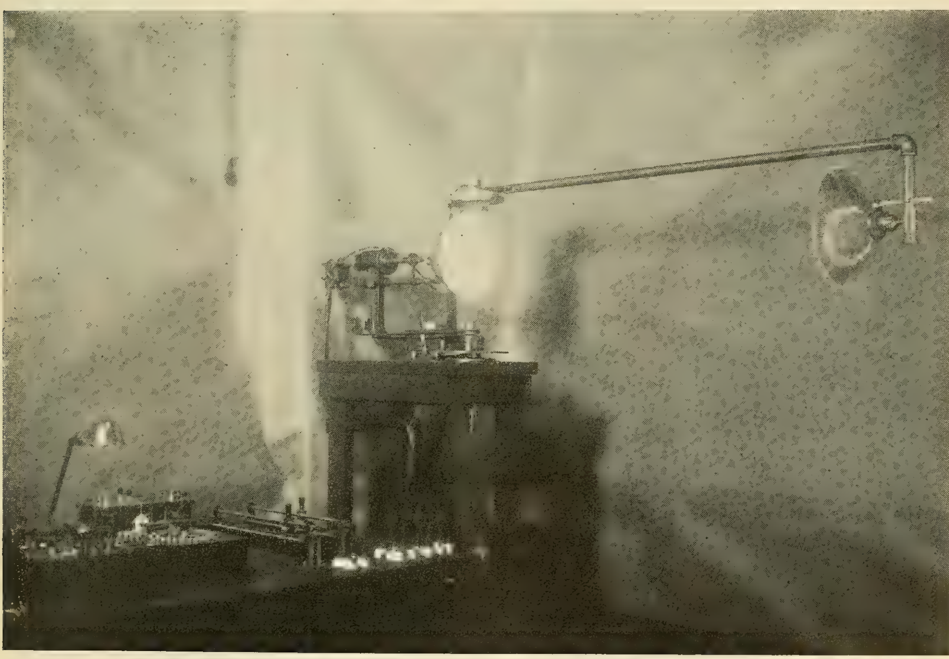


FIG. 3.—DEVICE FOR MEASURING COEFFICIENT OF REFLECTION AT DIFFERENT ANGLES.

possible to make a correct setting at or near zero degrees—that is, in angles directly below the unit—inasmuch as an extremely small error in the setting along the vertical line means a large error along the horizontal line. In the same manner, if the angles are measured off on the horizontal line, it is impossible to make an exact setting at or near 90 degrees—that is, for measurements of candle-power near the horizontal. To avoid this difficulty holes are drilled in the track on the floor at distances to give the correct angles and a pin is dropped into these holes to give a correct setting for the photometer head end. The test lamp end is finally adjusted by means of a steel tape on which the angles are marked off.

By special holder devices it is possible to test with the lamp rotating or stationary and with the reflector rotating or stationary, to adjust the lamp so as to center the filament, to move the reflector up or down relative to the lamp, to test a combination of lamp and reflector inside of a two-piece sphere, to test lamps ranging from an incandescent lamp to a flaming arc lamp, to test upright and inverted gas burners.

A Brooks' deflection potentiometer is used for the measurements of voltage and current. The advantage of this type of instrument lies in the fact that it combines part of the great accuracy of a potentiometer with a part of the quick action of a voltmeter. On the other hand, if in certain tests the accuracy of a standard voltmeter were sufficient, this same accuracy may be obtained from the deflection potentiometer with a far less strain on the eyes in reading to the last place.

When small units are tested and the lamps can be burned horizontally while rotating, the tests are run on a smaller photometer, in which a horizontal spherical rotator is used. The photometer is set at a distance of 10 ft. from the unit tested and rests on the end of an iron-framed carriage or stand. This carriage may be moved on a track which extends through the building, so that tests may be made at any distance, from a foot to 30 or 40 ft. An investigation is now being made to determine the effect which testing at various distances has upon the distribution curves.

A third photometer, somewhat similar to the second, is used in commercial testing. A standard voltmeter is used in connection with this instead of the deflection potentiometers which are used on the other photometers.

In connection with the second photometer an apparatus has been devised for the measurement of the coefficient of reflection of surfaces such as wall papers, etc. This device is shown in Fig. 3. The material to be measured is fastened to a disc and the disc fastened to a universal rotator. The disc is illuminated by a lamp and reflector at the end of a 4-ft. arm, which is connected to the universal rotator. The arm may be turned through any angle relative to the disc and through any plane, so that the incident light on the disc may be at any angle and the reflected light measured at any angle. Published figures on the coefficient of reflection of surfaces have usually been obtained by measuring the reflected light at a fixed angle or by measuring the distribution of light through a single plane perpendicular to the surface and containing the line of direction of incident light. Both of these methods are wrong unless the surfaces give perfect diffusion, and this is far from the case, as shown by F. H. Gilpin.* Using the apparatus just described a more correct coefficient of reflection can be obtained by making tests in a number of planes. It is necessary that the incident light fall on the reflecting surface in a parallel beam in order that a fixed angle of incidence may be obtained. In order to do this a parabolic reflector is used and with it a high candle-power lamp having a very compact form of filament.

Of all three the photometer Lummer-Brodhun screens of the contrast type are used. Because of the very great range in candle-power in tests of reflectors it is necessary to have long tracks for the comparison lamps, but in addition each photometer has a sector disc, which may be placed on the test lamp side or the comparison lamp side, and therefore the range is increased to a great extent. Probably the most useful adjunct to a photometer is the sector disc.

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* Transactions of the Illuminating Engineering Society for December, 1910.

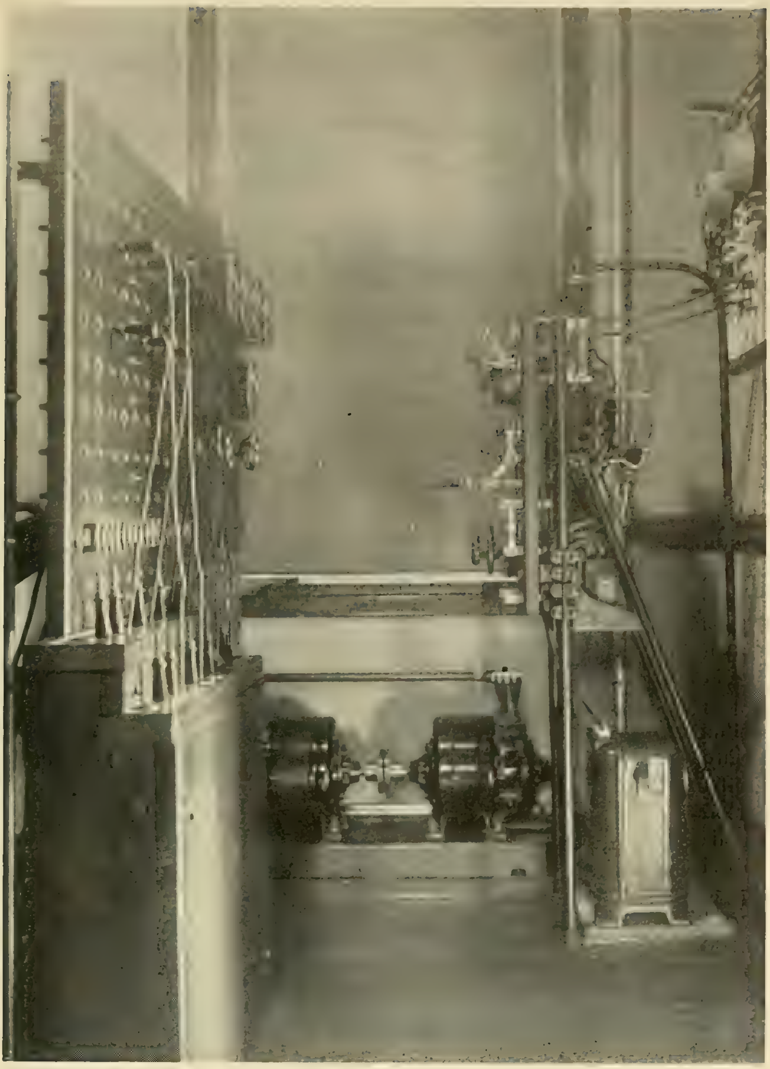


FIG. 4.—APPARATUS FOR MAINTAINING CONSTANT CURRENT, AND SWITCHBOARD.

An important part of the complete photometric laboratory is the facility for obtaining constant voltage of either alternating or direct current and of voltages covering the range of battery lamps to 250-volt lamps. Where life tests of lamps are made an elaborate scheme of distribution is necessary, but where the current is supplied to photometers only, as in this case, the charging and distributing apparatus may be quite simple, as shown in Fig. 4. The mercury arc rectifier on the right is used to charge the storage batteries which are in a separate basement room directly below the switchboard room. The charging panel is shown on the left, toward the back, and the distributing panel arranged like a telephone switchboard is shown in front. When it is desired to test an alternating current lamp the motor-generator shown in the back is run off of the storage batteries and thus a constant voltage is obtained on alternating current as well as on direct.

Architectural Lighting Fixtures

Where Science and Art in Illumination Meet

Are lighting fixtures a part of the building, or articles of furniture? This question has been often asked, and can probably only be satisfactorily answered for each particular case. Undoubtedly lighting fixtures may be treated in either sense, but there would seem to be a general line of division between the two cases. If the interior is large enough to display the architectural motives of the building, then the fixtures may be properly treated architecturally; in all other cases the fixture may safely be considered a part of the furnishing. Auditoriums of all kinds and other rooms intended for large gatherings, as ballrooms and banquet halls, clearly belong to the former class. Where lighting fixtures are to be shown at all in such cases they must be of sufficient proportions to avoid appearing trifling and inadequate to their purpose on the one hand and of giving an appearance of useless weight and massiveness on the other; in a word, the sense of proportion must be very nicely kept.

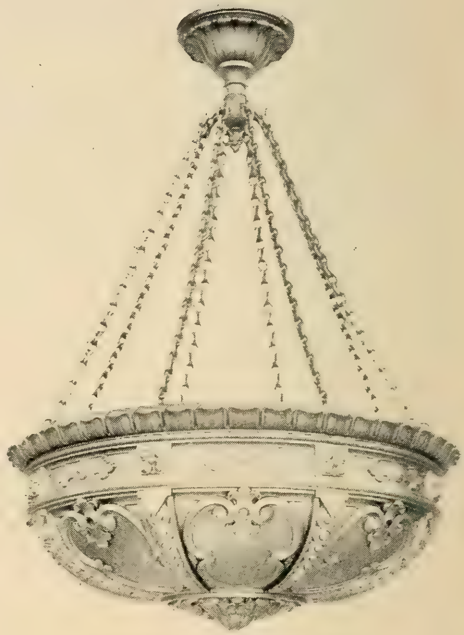


FIG. 2.

FIG. 1.

Indirect lighting lends itself particularly well to such architectural treatment.

FIG. 3.

The light-sources themselves being hidden, their relatively small proportions do not complicate the problem, while the single covering which conceals the units may be made of sufficient dimensions to afford an opportunity for architectural decoration. Fixtures of this sort are shown in Figs. 1 and 2. These are made of a special composition, which secures a minimum weight with maximum strength, which can be formed in molds, thus permitting exact and comparatively inexpensive duplication. The material may be finished by electro-plating, so as to give it the appearance of bronze or any other metal; or it may be treated to represent sculptured marble or other similar material. Such fixtures possess the size and massiveness requisite to harmonize with the structural features of an interior, and as they seem to be simply overflowing with light, do not suggest the absurdity of an enormous weight of metal used to support an insignificant weight of lighting apparatus. Furthermore, the fixture being one piece, the exposed surface is large enough to receive a broad, bold decorative treatment, which is essential in an object necessarily seen at a considerable distance.

Fig. 3 shows a smaller fixture of the same type, which would be well adapted to use in corridors, halls and smaller rooms.

Fig. 4 shows a fixture modified by the addition of direct lighting units. This is also a smaller fixture suitable for use in rooms with moderate height of ceiling, as public dining rooms, hotel lobbies and the like, where the additional color effect produced by the shades on the pendant lamps makes an additional decorative feature.

Fig. 5 is still another combination. The opaque bowl in this case is replaced with an art glass dome, which may be used for semi-indirect lighting, while direct lighting is provided for by the pendant lamps. This fixture is of such character and dimensions as to adapt it admirably to residence use. It would be an exceedingly handsome fixture for a music room or parlor, where the decorations were of such a character as to harmonize.

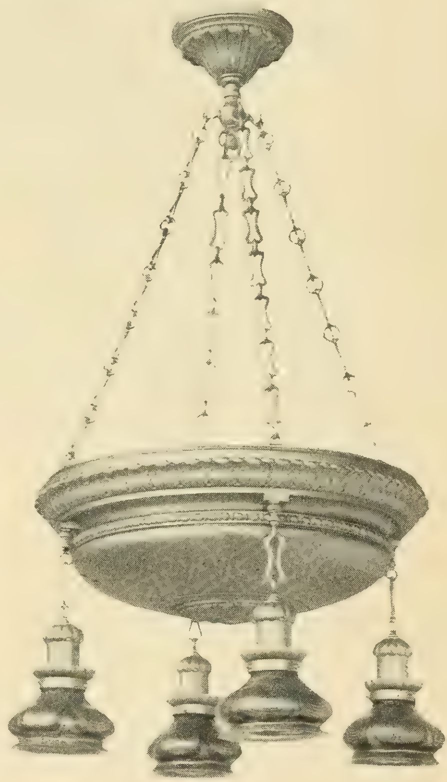


FIG. 4.

FIG. 5.

In all of the examples shown there is an entire absence of the old chandelier idea of construction, and a frank effort to utilize the enormous practical advantages which the electric light possesses over the old-time sources. There is no imitation either in the form of the light or the manner of its use. The tendency to conceal modern light-sources is unquestionably growing, and is destined to dominate the general methods of illumination in the not distant future.

Fig. 6 is a fixture designed to harmonize with the distinctly new school of architecture, which is exemplified in the work of Louis H. Sullivan and Frank Lloyd Wright. While their architecture has become familiar in the vicinity of our Western metropolis, and has attracted very marked comment in Europe, it has made practically no headway in the East. The fixture would also be suitable for rooms furnished and decorated after the arts and crafts manner.

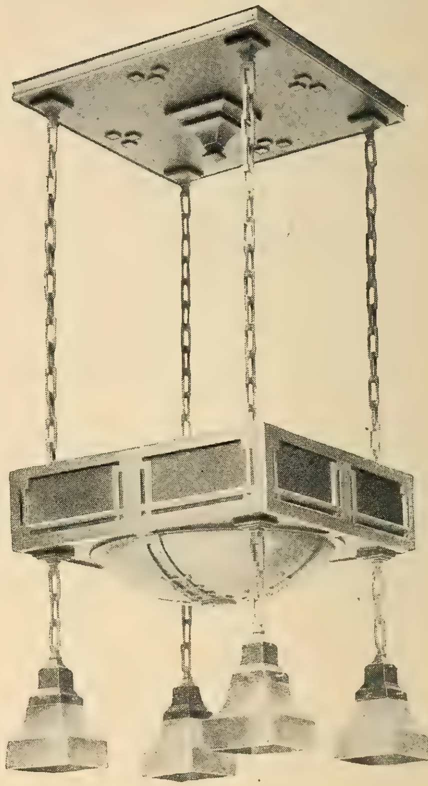


FIG. 6.

The Decorative Treatment of Arc Lamps

How a Lamp Formerly Considered "Hopelessly Plain" Can be Made a Thing of Beauty

By J. Woodley Gosling.

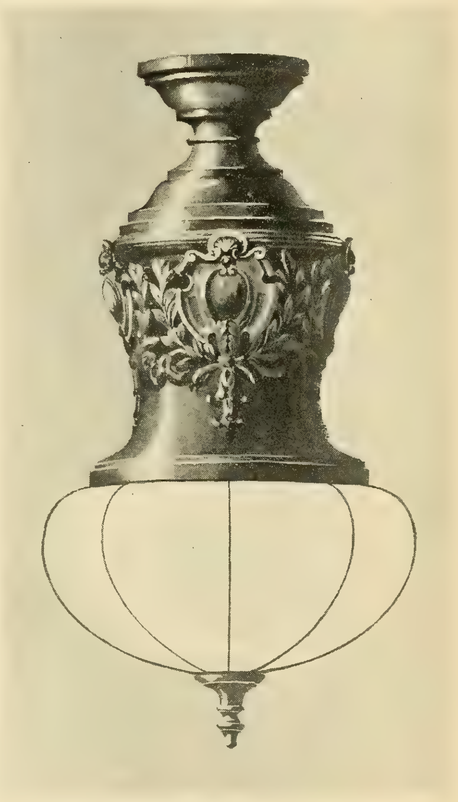
By reason of its novelty, as well as its higher efficiency, the tungsten lamp has occupied the center of the stage, so to speak, in most discussions of interior lighting during the past two or three years. The first commercial form of electric light, the carbon arc lamp has, relatively speaking, taken a back seat in popular attention. The description of the lighting of a prominent Fifth Avenue store in our last issue draws attention to the fact that the carbon arc has by no means lost its usefulness, but on the contrary has certain advantages, particularly in the color of its light, which still give it precedence for interior lighting in many cases; and, furthermore, instead of being considered a necessary evil in the way of looks, it can be made decidedly handsome in appearance when treated with real artistic skill and originality. The discussion of this particular phase of the installation by the one who is largely responsible for its success should therefore be of more than passing interest.—Editor.

The problem of effectively lighting a store of the type referred to in the paper entitled "Lighting a Fashionable Woman's Apparel Store," appearing in the last issue of The Illuminating Engineer, has many interesting features for the man who is to handle the ornamental part of such an installation.

He is governed by various and sometimes complicated elements. To begin, he must, of course, work in harmony with the illuminating engineer, keeping his fixtures of such design, both in ornament and construction, as to give the quantity and quality of illumination required; must bear in mind the general decorative scheme of the building; and evolve a design which will please the personal taste of the proprietor of the store, and meet his appropriations for decorative treatment. And, lastly, the light units must be so treated that they will not become monotonous when used in repetition, and they must necessarily be of such simple mechanical construction as to require as little care as possible after installation.

The last mentioned feature is one of great importance, and bears directly on the principle that all ornamental design must be governed by the form of the object to which it is to be applied, and must not in any way hamper its usefulness nor detract from the idea which it represents, nor attempt to disguise the object so that it will appear to be something different from what it was originally intended to be.

No attempt was made in the fixtures



AN ARC LAMP WITH SPECIAL ORNAMENTAL CASE.

designed for the Bonwit-Teller Building to convey the idea that they were not arc lamps; the problem was to take the lamp as it left the hands of the maker and design such casings as would make the lamp a thing which would be pleasing to look upon, and of such pattern as would satisfy the ideals of the architect, the illuminating engineer and the proprietor.

The recessed arc lamps are decidedly unique for the lighting of large spaces, and presented many more difficulties on the mechanical side than on the ornamental. The purpose in this case was to make them as inconspicuous as possible, leaving the bolder attempts in ornament to be expended on the large suspended units.

The lamps used on the second and third floors required a much less pretentious design, as the ceilings are lower and the rooms lighted were not to be used for such extensive display as on the first floor; but they are of a corresponding treatment in the details of the ornamentation.

This installation, the engineer of which was Mr. Alphonse Kaufman, who is associated with Mr. P. R. Moses, has been the means of developing another in the same building wherein the "intensified" arc lamp is used, but under conditions which are quite different from those presented on the main floor. The ceiling here is low, and the lack of the deep, false beams made the recessed lamp impossible, thus compelling the designing of a type of casing which would admit of the lamp being suspended close to the ceiling.

The accompanying sketch shows the general appearance of this new type of casing. The total length is somewhat less than 30 in. Though ornamental, it has been given a more simple treatment than those in the rest of the building, but is equipped with glassware of a similar character. The construction possesses some mechanical features which are quite distinctive. The casings, when once installed, remain a permanent detail in the decorations; the simple removal of a lamp from its casing does not disturb the arrangement of the fixtures on the ceiling. This detail also has the advantages of protecting the ornament, glassware and metal finish from rough handling, and admits of easy access to the mechanism of the lamp.

The room in which these fixtures are installed has very little of that extensive display shown on any of the lower floors, it being used for the showing of goods which do not require quite so much of the element of allurement. The proprietors wished to have a certain amount of attractiveness in their show rooms where the goods which are shown are mainly colored, and require a well diffused light as near sunlight in quality as can be reasonably obtained.

The effort of the designer of fixtures for lighting stores of this type must clearly be with a view to obtaining a great deal of light; hence the avoidance of obstruction by any useless ornament or unnecessary accessories, the idea being that, while the fixtures must be ornamental, the sacrifice, if any, must not be with regard to light.

Almost all ornamental forms have been created through an effort to decorate some one of man's inventions, and the creation of new mechanical devices which have been accepted as a necessity in their bare mechanical form, in time require certain attention when they are to be used where things must be pleasing to the eye; the arc lamp is an object which, when taken by itself and considered from an ornamental standpoint, must be considered quite apart from the accepted forms of the classical treatment of lighting fixtures.

Illuminating Engineer, or Lighting Specialist?

There are still some persons actively interested in the production or use of light who shy at the term "illuminating engineer." Two instances that have appeared in public print recently are Mr. G. E. Williamson, of the Denver Gas & Electric Company, and Mr. F. L. Godinez, who is now doing consulting work, but was formerly connected with the Doherty and Holophane interests. In a paper on "Illuminating Engineering," read before the Commercial Council of the Denver Section of the N. E. L. A., Mr. Williamson attempts the oft-tried task of defining an illuminating engineer. His effort reads thus:

> "He is an individual who has a very thorough technical education in physics, chemistry, higher mathematics, psychology, physiology, etc. He has also a practical knowledge and experience in the design, manufacture and testing of lighting units, shades, reflectors and instruments for measuring illumination. Therefore, the real illuminating engineer is the servant of the commercial man in furnishing lighting units, reflectors, data, etc., for his use."

He then mentions several well-known scientists as examples of "real" illuminating engineers, and proceeds as follows:

> "If we are together now on what an illuminating engineer really is, let us call the department having charge of special illumination the 'Illuminating Department,' and those working on illumination 'Specialists on Illumination.'"

Mr. Williamson's objection to the term "illuminating engineer" seems to be due to the assumption of the title by those who could not qualify as experts on the subject. This is, of course, unreasonable on the face of it; he might as well object to the term "physician," or "doctor," because there are a certain proportion of "quacks," who use the title without the knowledge and experience which it should imply. Furthermore, his definition of an illuminating engineer, especially in view of the examples cited, is not in accord with the accepted definitions of other branches of engineering. He has limited the term to physicists, scientific investigators and inventors, who have no more right on account of their achievements to be called illuminating engineers than they have to be called electrical engineers or civil engineers. The fact that a scientist knows how to design and operate an electric meter, for example, does not constitute him an electrical engineer, any more than the manufacturer of a transit is thereby a qualified civil engineer. Some of the gentlemen mentioned by the writer would emphatically refuse to accept the title of "illuminating engineer" were there any means of bringing the point to issue.

The words "engineer" and "engineering" are applied, and appropriately so, to many different phases of human activity. Engineering is fundamentally based upon economics. The oft-repeated definition of an engineer as "one who can do with one dollar that for which the layman would require two" cannot be excelled as a rough-and-ready summation of his abilities. The illuminating engineer is interested in the higher scientific aspect of the nature of light, the physics and chemistry of its production, and the refinements of its measurement only as a

collateral branch of his subject which serves the purpose of broadening his view and adding interest to his work. He can be an exceedingly competent, practical engineer, with a very limited knowledge of this side of the subject.

The value of the work of the illuminating engineer depends upon two things: his knowledge of what kind of illumination is suitable or best for each particular purpose, and how to produce such illumination most economically under the conditions surrounding each problem. To know how to do these two things well requires a sufficient specialization in the general field of scientific knowledge to fairly entitle its possessor to be called an expert—*i. e.,* an engineer—and there is no other word or term that so completely and clearly expresses such knowledge and ability as this word " engineer " or " engineering."

We have the older divisions of applied science using the term, such as " Mechanical Engineer," " Naval " and " Military Engineer," "Electrical Engineer," "Mining Engineer," and in the more recent subdivisions of science, the " Sanitary Engineer," the " Heating and Ventilating Engineer," and " Refrigerating Engineer," and among the most recent of all, the " Efficiency Engineer." What sense is there then at shying at the exactly analogous title, " Illuminating Engineer "? It will need a better reason than that the term has sometimes been misused through ignorance or design to pass upon it the sentence of excommunication. The use of a phrase obviously intended to avoid meeting the issue squarely, such as " lighting expert," carries a tinge of suspicion that its user either doubts his own right to the title of engineer, or is not wholly free from the taint of commercialism which he professes to deplore. " Methinks he protests too much."

Artificial Daylight and Its Use

By artificial daylight is meant a light having the same composition of colors, and which will therefore show colored objects exactly as they appear under natural light. It is a familiar fact that daylight itself varies in color, depending upon the position of the sun in the sky, whether the sky is clear or clouded, and the character of the clouds; but great as this variation is when carefully analyzed, it makes no appreciable difference in color perception provided the light is of sufficient intensity to enable us to see distinctly.

The means of producing a light of this quality artificially have long been sought. Especially has attention been given to this within the past few years. It was the topic of discussion at the last meeting of the New England section of the Illuminating Engineering Society. The present status of the problem is as follows: There is no single artificial light-source which produces light that is the exact equivalent of sunlight; the nearest approach to this is the Moore " vacuum tube " light, using carbon dioxide as the radiant. This is so near the equivalent that it has been used in dye works for the matching of colors. A scientific analysis of the light, however, shows that it is lacking in a few of the rays contained in sunlight, which affect certain shades of brown. In scientific language, the incandescent carbon dioxide produces a line spectrum, whereas the solar spectrum is continuous. Just what this means may be most easily comprehended by comparison with sound. Color in light is the exact equivalent of pitch in sound, the blue representing the highest pitch and red the lowest. In the continuous spectrum, of which the rainbow is a familiar example, there is no line of division between the colors, the one blending into the other by imperceptible degrees. It corresponds to the slide in a musical note, such as would be produced by bowing a violin string while sliding the finger up the finger board. The line spectrum consists of sharply defined bands of color and is analogous to the different tones that are produced by fingering a violin string so that the pitch changes abruptly instead of gliding from high to low, or vice versa.

The most pronounced case of a light having a line or discontinuous spectrum is that produced by the mercury vapor lamp, in which the red is almost entirely missing, the light consisting of bands in the green, yellow and blue, which gives to the light the familiar peacock-blue color. It is a general principle in physics that luminous gases give line, or incom-

plete spectra, while incandescent solids give continuous spectra.

The reason that our common light-sources which use solid radiants do not give the same quality of light as the sun is that we have no means of maintaining such a solid body at the right temperature. In the incandescent electric lamp we cannot get the temperature high enough, and in the arc lamp it may be too high and is variable. The only means of reproducing daylight absolutely is, therefore, by using the light-source that is nearest to it in quality, and suppressing or filtering out the colors that are in excess. Various means of doing this have been proposed and some of them have been worked out so that they may now be considered available for practical use. Briefly, the conclusion is this: Where daylight values are absolutely essential for distinguishing color they can be produced artificially without entailing prohibitive cost.

The extent to which light of daylight quality is desirable is a point upon which there is much disagreement; some claim that it is desirable in all cases, and the only reason why it is not used at present is on account of the difficulty and expense of producing it. Others contend that the warmer toned artificial light, with which man has been familiar for thousands of years, is more desirable than the colder white light of day for ordinary purposes of vision. We are much inclined to agree with this latter contention, if for no other reason than that the change in itself is a relief, just as change in seasons, or in the weather from day to day is preferable to a constant temperature.

There are, however, a number of important exceptions in the way of special cases. Perhaps the most important of these is the lighting of stores in which the color of merchandise is one of its essential qualities. The modern store as compared with its predecessors is a palace of merchandise, and yet in this one respect of light, which of all things is the most important, there is a sad deficiency in regard to color. In the case of goods that are to be seen by daylight it is necessary to take them to the windows, often some distance from their department, in order to properly judge of their color. There is no longer any necessity for this inconvenience. While artificial daylight is considerably more expensive to produce than light of the ordinary quality, it is not sufficiently so to justify this annoyance and inconvenience to customers. Every department or store where colored goods are handled should have at least a section of it lighted with artificial daylight so that the goods can be readily examined under daylight conditions. To use artificial daylight exclusively would be an equally serious mistake in the opposite direction, for colored goods are seen under ordinary artificial light as well as by daylight, and the customer should be able to judge of their appearance under this condition as well. The lighting of a store so as to embody both of these facilities is a matter which should have the attention of every merchant handling goods in which color is an essential element.

Professional Ethics

Among the various attributes which a person is supposed to acquire in the process of study and training requisite to entitle him to a place in the professions, is a certain degree of respect for the rights of his fellows, and honor in observing these rights. In all of the older professions this holds true to a very large extent. A physician who would deliberately seek to win a patient from another physician would be refused fellowship in the medical societies and generally ostracized by the profession; and the same punctilious regard for personal rights is observed among lawyers. In the professions which deal with the material affairs of life, however, there is a less strict observance of this code of honor, at least in this country, even among the professions that enjoy the highest prestige. A number of years ago the American Institute of Electrical Engineers formulated a code of ethics for this profession through the agency of a special committee. Among the provisions of the code were the following:

"Where engineering work is in charge of an electrical engineer, no other electrical engineer should undertake the work except on request of or in co-operation with the electrical engineer who had charge of the

work before, unless the latter's connection with it has already terminated.

"An electrical engineer in responsible charge of work should not permit other engineers or non-technical persons to overrule his electrical engineering decisions. If this is done and persisted in, he should as soon as is practicable withdraw."

To what extent these principles are carried out in actual practice we have no means of definitely knowing, but apparently there is no large amount of transgression.

During the past six years there has been a definite effort made in this country to establish illuminating engineering as a distinct branch of science and a separate profession, and the claim has often been made that the effort has resulted in actual accomplishment—that illuminating engineering to-day does exist as a science and profession. While there are a number of highly convincing evidences of this fact, there are also some evidences to the contrary that cannot be overlooked. Foremost among these is the total lack of professional courtesy which prevails. The fact that an illuminating engineer has a commission, or, in common phrase, a "job," instead of being a tacit notice to others in the profession to keep "hands off," it is a signal for a general scramble to see if the job cannot be taken away from him. Especially is this the case when it is known that some particular system or form of illumination is to be used; every one commercially interested in other forms of illumination considers it his special privilege to do all in his power to discredit the system recommended by the illuminating engineer, and to put in his own instead. As a result the client soon becomes suspicious of the whole illuminating engineering fraternity, and very rightly so.

Much excellent scientific work has been done to form the basis of this new science, but as a profession it has not yet succeeded in sufficiently shaking itself loose from commercial interests to establish itself on an ethical basis. So long as concerns who advertise illuminating engineering departments persist in attempting to crowd themselves in where an illuminating engineer has already been employed, and to discredit or oppose his work, illuminating engineering as a profession will be a mere joke and pretense in the eyes of the established professions and the public. Illuminating engineering aims at as high a purpose as any of the professions —viz., the securing of the best possible, conditions of artificial illumination—and it will be a pity if a profession having so fundamentally sound and important work is made a matter for jeers and laughter by the uncurbed greed of those commercially interested in the materials and apparatus used. Until there is some semblance of observing the code of ethics that has been established in the engineering and learned professions, illuminating engineering will never rise to the dignity of a real profession.

What's in a Name ?

This question has been propounded many a time since Juliet cogitated the subject in her monologue; and it must still recur so long as language exists. Names are the foundations upon which all thought rests, and the definiteness of ideas and the logic of arguments is dependent upon the exactness of conception of their meaning. If we communed only with ourselves definite names would be unnecessary, as was the case in Juliet's reverie; but the moment we seek to communicate thought a common understanding of names becomes essential. So much for the metaphysical discussion of the title; now for its application to a special case.

There is a movement on foot to change the name of the Illuminating Engineering Society. One of the directors has sent out a letter to the members asking their opinion as to the advisability of such a move and requesting them to suggest names if they approve of the change; and the proposition received at least a semblance of sanction from Mr. V. R. Lansingh, the new president of the society, in his inaugural address at the annual meeting. The old question, then, applied to this special case must first be answered: What's in the name, "Illuminating Engineering Society"? As previously stated in these columns, the name was taken after careful deliberation in order to avoid the assumption of an exclusively professional association, which would have been the case had the

title taken the form usually given to other engineering bodies, such as the "Association of Illuminating Engineers." At the same time the title implied the existence of a science and profession of illuminating engineering. The object of changing the title, as set forth in the circular letter referred to, is to prevent the drawing of such a conclusion by getting rid of the word "engineer," or its derivatives.

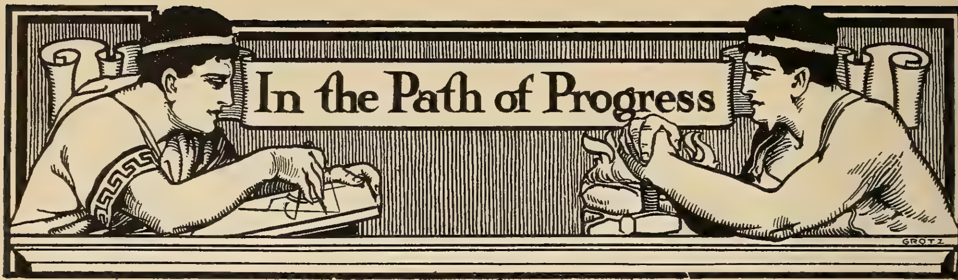
The reason set forth for such a change is that the present name antagonizes certain interests which ought to be represented in the society. While these are not specified, it is clear that architects, decorators and fixture manufacturers are the ones referred to.

When the society was started the chief purpose, or at least one of the chief purposes, in the minds of those who took part was to establish illuminating engineering as a distinct science and profession, and the course of lectures given under the auspices of the society at the Johns Hopkins University, a year ago last fall, was looked upon with great pride and satisfaction as being the final act in this establishment. It appears now that there is a contingent in the society who either consider this a serious mistake, or that there is no such thing as illuminating engineering or an illuminating engineer. By the way, the author of this letter is the same member whose anxiety to know "What is an illuminating engineer?" led to the giving up of an entire meeting of one of the sections to a discussion of the question. The proposal to change the name of the society would seem to indicate that the question has never been answered to his satisfaction.

The first point to be decided is whether there *is* a branch of applied science comprehended by the term illuminating engineering, and a profession of those who are especially proficient in this science. If not, then of course the phrase "Illuminating Engineering Society" is a misnomer and a bluff. If, on the other hand, illuminating engineering exists as a science and profession, the society must either stand as the representative and exponent of such science and profession, or it must take a place among social organizations and clubs. The trouble is that the society has been trying to be both of these things at once, and has so placed itself in an anomalous position; and, as we previously pointed out, such highly self-respecting professions as architecture can scarcely be expected to recognize the equality of such a heterogeneous combination. The conspicuous absence of the architectural fraternity in the membership list of the society is no less apparent than the desirability of the co-operation of this profession. But membership and co-operation are by no means synonymous terms. How many architects are members of the electrical, mechanical, or other engineering societies? And yet this is not looked upon as a serious defection or a lack of appreciation of the usefulness of these professions in their own proper spheres.

That a change in the name of the society is desirable there is very little doubt, but the change should remove the generality in the original title and definitely express its right to existence. The name should read "American Association (or Institute) of Illuminating Engineers"; the word American is desirable to distinguish it from the society established in London. Furthermore, the activities of the society should accord with this name. The very great enlargement in the membership and work of the National Electric Light Association and the National Commercial Gas Association have removed from the Illuminating Engineering Society the necessity for continual discussion of the commercial and elementary phases of the subject, which have heretofore constituted so large a part of its proceedings. To continue to include this field is merely a useless duplication of work and will have no other result than tiring out the members and preventing their taking part in the real work of the society. If this commercialism were eliminated, and the work of the society directed to advancing the science and profession of illuminating engineering, properly so called, the acceptance of the work by the architects and other professions would be materially advanced.

To conclude: If illuminating engineering is only a pretense and a pseudo-science, then let us drop it at once; but if it has a legitimate reason for existence, then let us call it by its proper name.



New Publications

"LUX ET VERITAS."

The above is the classical title of a book recently issued by the Opalux Company, New York. This is the most elegant, most pretentious and in many ways the most complete piece of literature that has ever come into our hands from a manufacturer of illuminating glassware. The book is 6 x 9 in. in size, contains 129 pages of matter, and is beautifully bound in boards, with gold title on front and back. The paper is a heavy, matt surface, the finest of its kind made, and the printing in a gravure brown. The first sixty-four pages are taken up with a general discussion of the subject of light, with special reference to illuminating glassware. The remainder of the book contains illustrations and photometric curves of the different Opalux products, with complete engineering data.

The general descriptive matter deals briefly with a great many topics, ranging through the subjects of optics, physiology, physics, esthetics and ethics, which are treated in a rather transcendental style. The writer is somewhat given to a frequent use of the loud pedal in the form of italics. The reasoning in some cases is adroit, and the conclusions more plausible than logical.

The engineering data is the most complete of any commercial publication that we have seen. A page is devoted to each separate size and type of reflector, on which are given a half-tone cut, a distribution curve showing the lamp bare and with the reflector, complete photometric data as to mean spherical candle-power, effective lumens, etc., and a table giving the intensity of illumination produced by the given combination of lamp and reflector for all horizontal distances up to 24 ft. with the unit at distances from 4 to 20 ft. high. Besides the special data there is a section devoted to general information and engineering formulas. A number of fixtures are shown equipped with various types of glass as suggestions of its possibilities. The book has a real value to all interested in illuminating engineering, whether they have occasion to use the particular glassware shown or not.

WESTINGHOUSE ILLUMINATION DATA.

The January issue is a pamphlet of thirty-two pages, published by the Westinghouse Electric & Manufacturing Company, incandescent lamp department, Bloomfield, N. J., having the title "Factory Lighting Problems, a Compilation of Articles by C. E. Clewell, Edited by Norman Macbeth." Most of these articles appeared in the *American Machinist,* and are reviewed elsewhere in this issue. This is a digest rather than a reprint, and brings the principal points of Mr. Clewell's valuable articles within the reach of all those having to deal with factory lighting.

A NEW ERA IN LIGHTING.

This is the title of a small pamphlet issued by the General Electric Company, Schenectady, N. Y. It gives a brief history of the development of the electric light, explains the cause of the higher efficiency of the Mazda lamp and gives some general advice in regard to the proper use of illumination. It is written in a distinctly popular vein, and is intended to give the average user simple but useful information which may aid him in his selection of lamps and accessories. Among other things is shown a complete electric lighting installation for a typical eight-room house. It is a very useful little

booklet for householders who wish to have a more intelligent knowledge of the use of electric light.

THE LIGHTING OF OFFICES, BANKS AND PUBLIC BUILDINGS;

THE LIGHTING OF HOTELS, CAFÉS AND CLUBS;

THE LIGHTING OF IRON AND STEEL WORKS;

THE LIGHTING OF TEXTILE MILLS.

The above are the titles of four booklets issued by the General Electric Company, Schenectady, N. Y., in which numerous illustrations are given of typical lighting installations, together with general information and advice upon the subject. There is also engineering data showing how to select the proper size of lighting units, and how to figure operating and maintenance costs. The books, as in all pieces of literature issued by this company, are handsomely executed and clearly written, and are instructive in the particular subjects with which they deal.

ARTS AND CRAFTS IN FIXTURES AND GLASS.

Under this title the Holophane Company, Newark, Ohio, has just issued a very handsome portfolio of drawings, giving studies in fixture design equipped with the more decorative forms of Holophane reflectors. The designs are contributed by representative fixture houses throughout the country, and present a very wide range of conception and execution. The forms of glassware shown are new, and in most cases a distinct departure from the reflectors that have become so familiar within the past few years. A brief description of each fixture, together with the maker's name, is given on the back of each sheet.

Those who have been led to assume that prismatic glass is necessarily utilitarian and commercial will find themselves happily mistaken by looking over this portfolio, which shows decorative possibilities heretofore unknown with this type of illuminating glassware.

"IRIS" ILLUMINATING GLASSWARE.

A very handsome catalogue issued by the Fostoria Glass Specialty Company, Fostoria, Ohio, illustrating a line of colored globes and shades sold under the name of "Iris." The coloring is of the Tiffany order; typical shades are shown in color process engraving.

ORNAMENTAL STREET LIGHTING AND ALBA GLOBES.

A booklet of thirty-two pages and cover, issued by the Macbeth-Evans Glass Company, Pittsburgh. Besides a general discussion of ornamental street lighting and descriptions of Alba globes, are illustrations of prominent installations, typical specifications and illumination curves and charts showing the actual results obtained. The book is exceedingly well executed and contains useful and reliable data on the subject.

THE COOPER HEWITT ORTHOCHROMATIC LAMP

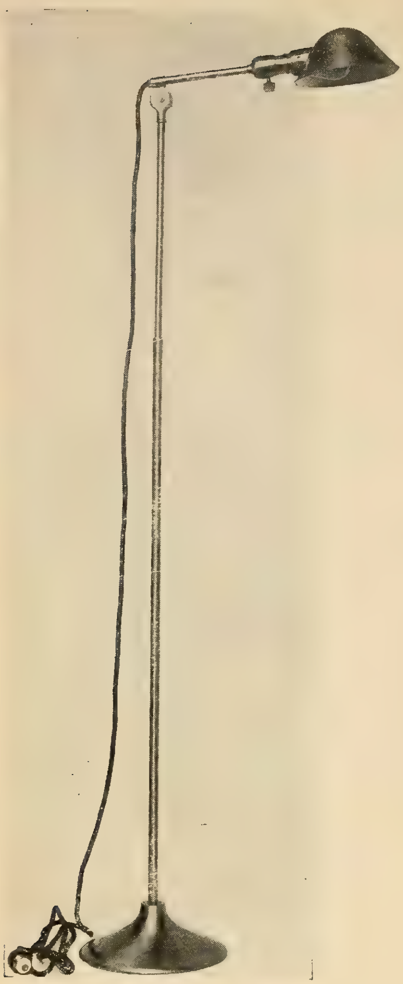
This pamphlet of eight pages is Bulletin No. 41 of the Cooper Hewitt Electric Company, Hoboken, N. J., and gives a full description of the new lighting unit now offered by this company. As the name implies, this unit is designed to give a practically white light. This result is accomplished by using a tungsten lamp of sufficient size to afford the necessary amount of red and orange rays, in combination with a mercury vapor tube. The bulletin shows the details of construction of the unit, a number of installations, and different types of ornamental cases.

Nubolux Reflectors

Under the above trade name the Lensed Electric Shade Company, 101 Warren Street, New York, have put upon the market a line of alabaster shades. There are two types of design, one of the "Sheffield" order, the other a simple fluting. Each is offered in three different contours and several sizes.

A Convenient Portable Lamp

No matter how many "fixtures" may be provided, there are always cases where a special light is wanted that the fixture does not provide. Frequently this can be secured by the use of a lamp placed on a table or attached to a desk, but a lamp resting upon the floor is still more adaptable. For downright convenience and universal application the portable lampstand illustrated herewith has the lead. It is so light that it can be carried about



THE MORSE PORTABLE FLOOR LAMP.

as easily as an ordinary hand lamp, is adjustable in height and in every other manner that can possibly be required, is inconspicuous, so simple as to "harmonize" with any kind of surroundings, and sufficiently modest in price to place it within the reach of any one who really appreciates the convenience of a light just where it is wanted. Like some other modern devices, it is one of those things that becomes more appreciated as it is more used, and which the owner would not willingly give up for many times its original cost if it could not be replaced. A hundred uses will be found for it when once its universal adaptability is discovered by actual possession. It is manufactured by Frank W. Morse, 516 Atlantic Avenue, Boston, Mass.

The New Benjamin Lamp Grip

The Benjamin Electric Manufacturing Company of Chicago is placing upon the market a new device which will play an important part in the prevention of lamp breakage, accidents and general inconvenience, due to the loosening of lamps in places where there is any considerable vibration, such as factories, steam cars, street cars, shops, etc.

The device consists of spring grips, operating through slots in the threaded socket shell and engaging the lamp base with sufficient force to prevent the lamp from loosening and falling out.

Its advantages are apparent. It prevents lights from going out unnecessarily, saves time in readjusting them when they work loose, as is often the case during the day; also prevents accidents in dangerous quarters where the lamp might strike the workmen, and, further, saves the lamp itself from breakage.

The company is prepared to supply this lamp grip, with its entire line of reflector sockets covering the range of lamps from 25 to 500 watt, and is now adapting it to its other lighting units.

NEW BENJAMIN LAMP GRIP.

Proceedings of Technical Societies

The Illuminating Engineering Society

The annual meeting of the society was held in the rooms of the Machinery Club, 50 Church street, New York, on the evening of January 12. The meeting was preceded by a dinner at which Dr. A. E. Kennelly, the retiring president, acted as toastmaster. The gathering was notable for two things: it was the largest annual meeting ever held by the society, and there were present the presidents or representatives of a large number of the older technical associations. The guests of honor at the speakers' table were: Mr. B. R. Shover, president of the Association of Iron and Steel Electrical Engineers; Dr. W. H. Tolman, Curator of the American Museum of Safety; Prof. C. A. Martin of the College of Architecture, Cornell University; Dr. A. C. Humphreys, president of the American Society of Mechanical Engineers; Mr. Walter Cook, president of the American Institute of Architects; Mr. Gano Dunn, president of the American Institute of Electrical Engineers; Mr. Ira C. Copley, president of the American Gas Institute. All of these representatives expressed their appreciation of and hearty co-operation with the movement to bring the Illuminating Engineering Society into closer touch with their respective organizations. At the conclusion of their remarks, Dr. Kennelly called up the Committee of Tellers to present its report, which showed the election of the following officers:

President, Mr. V. R. Lansingh; vice-president representing New York Section, Mr. Norman Macbeth; general secretary, Mr. Preston S. Millar; treasurer, Mr. William J. Serrill. Directors, Messrs. A. J. Marshall, C. J. Russell and R. C. Ware.

Portions of the secretary's report were read, which gave an analysis of the work of the society during the past year. The treasurer's report showed that the disbursements and receipts for the year practically balanced.

New York Section.

The regular monthly meeting was held on the evening of January 11 in the United Engineering Societies' Building. Mr. H. Thurston Owens of New York gave an illustrated address on "A Résumé of Street Lighting Conditions, with Special Reference to New York." Interesting figures were given, showing the magnitude of the public lighting problem of Greater New York, and stereopticon views, which traced the history of street lighting from the first use of gas to the present time. New York has 2000 miles of streets illuminated by 80,400 lamps at an annual cost of $3,170,000. Mr. George S. Barrows of the United Gas Improvement Company, of Philadelphia, described the various forms of high pressure gas lighting units that are largely used in England and Europe. His descriptions were illustrated with lantern views.

Mr. O. L. Johnson of the Engineering Department of the National Electric Lamp Association, Cleveland, discussed the Methods of Street Lighting with Incandescent Lamps, referring to the installations in Warren and Niles, Ohio, as good examples of this method, and stated that street lighting of this kind had been installed in from 200 to 300 cities and towns during the past year.

Mr. S. L. E. Rose of the General Electric Company, Schenectady, described the

new luminous arc system recently installed in New Haven, Conn.

Philadelphia Section.

The regular meeting of the Philadelphia Section was held at the Philadelphia Electric Company's Building, 1000 Chestnut street, on Friday evening, January 19, 1912.

The programme opened with a fifteen-minute educational talk by Prof. A. J. Rowland, director of the School of Engineering, Drexel Institute. By means of a few demonstrations, with simple apparatus, the theory of the origin of light waves, sound waves, etc., was made plain.

The papers of the evening were: "The Architect and the Illuminating Engineer," by Mr. V. R. Lansingh, and "Illumination of Interiors by Daylight and by Artificial Light," by Mr. L. B. Marks. Mr. E. L. Elliott, editor of The Illuminating Engineer, also addressed the meeting, and all three gentlemen were accorded a hearty vote of thanks for their remarks and their kindness in coming from New York to attend the Philadelphia meeting.

Mr. Lawrence Vissacher Boyd (architect), Mr. W. J. Serrill and Mr. R. B. Ely took part in the discussion, which was followed by a biograph picture of "The House Electrical."

Mr. W. A. Castor, superintendent of meters of the United Gas Improvement Company, exhibited some gas meters, and explained their mechanism.

This was the largest meeting ever held by the Philadelphia Section, 243 being present.

New England Section.

The first meeting of this section during the present year was held on the evening of January 22. The general subject under discussion was "Means of Producing Daylight Effects with Artificial Light-Sources." Papers treating on the subject were presented by Messrs. Sharp and Millar, Dr. H. E. Ives and Mr. R. B. Hussey. The meeting was well attended, and the discussion showed a lively interest in the subject of the papers.

Chicago Section.

The regular monthly meeting was held on the evening of January 18, at which Mr. J. R. Cravath, as chairman of a committee appointed on December 20, to confer with the city authorities on the hanging of the new flaming arc lamps which the city is about to install, made a report. It was recommended that the lamps be hung 30 ft. high instead of 20 ft., as in the experimental installation. The city electrician, Mr. William Carroll, has the matter under advisement, and will experiment with the lamps at the height recommended. The work of the committee is to be continued with the addition of Messrs. George C. Keech, A. D. Curtis and R. F. Shuchardt to its membership.

Review of the Technical Press

American Items

New Books

Book of Home Building and Decoration; Prepared in Co-operation with and under the Direction of the Leading Manufacturers of the Country, by Henry Collins Brown; Clara Brown Lyman, Editor. 200 pp., 9 x 12. Illustrated in half-tone and color process. Cloth. Doubleday, Page & Co., New York. Price, $3, net.

The first impression that the reader will obtain on glancing at this book is the elegant and sumptuous manner in which it is gotten up. The paper is the finest plate finish, and the illustrations, which adorn every page, are either the finest of half-tones printed on an India tint background, or are in three-color process. The type is a large, modern Scotch face, which the eye can hardly avoid reading, so legible and attractive is it.

The topics treated cover the entire field of house building and furnishing. There are three chapters dealing with illumination: How to Get Full Advantage from Electric Light in the Home; Acetylene—Artificial Sunlight—in the Home, and Lighting Fixtures. The articles are carefully written and the subjects discussed from the viewpoint of the housewife and *pater familias*.

The book will be a perfect delight to any one who contemplates, even in the remote future, the building, furnishing or decoration of a home, and should be set down as the very first item of expense. The cost of the book will be cheerfully credited to profit long before interest in its pages will have ceased.

Arts-Crafts Lamps, by John D. Adams. 87 pp. Illustrated. Pocket Size. Cloth. Popular Mechanics Company, Chicago. 50 cents, net.

This is one of the handbooks issued by the publishers of *Popular Mechanics* and gives detail working drawings and perspective views of a large variety of electric lamps that can be constructed of wood and simple pieces of metal and glass by any one reasonably handy with tools. The designs are exceedingly clever and expressive of the arts and crafts motives. To those who enjoy the inimitable pleasure of creative work this little book points the way for many a delightful hour of effort, and the joyful contemplation of the results for all time thereafter.

Lamps and Shades in Metal and Art Glass. A companion volume to the above, fulfilling the same purpose in regard to the subject which it treats. Same price.

Increasing Human Efficiency in Business, by Walter Dill Scott, Professor of Psychology and Director of Psychological Laboratory, Northwestern University, Evanston, Ill. 331 pp. Illustrated. Cloth. The Macmillan Company, New York. Price, $1.25, net.

It is a notorious fact that the "self-made" man who formerly played so conspicuous a part in the practical affairs of our country was much given to worshiping his Maker, and not a little inclined to scoff at the idea of school training for business. While "book learning" alone

will never make a successful business man, any more than it will make a successful doctor, or lawyer, or preacher, or engineer, it has come to be recognized that a truly scientific study of any subject is of distinct value to those who intend to work only in the practical field. It has been very truly said of science that it is "a mode of thought," and also that this mode of thought has not only led the way to what is generally classed as scientific knowledge, but is the only mode of thought by which any knowledge is acquired. The only difference between the successful man who is untaught and the one who has been schooled is that the former uses the scientific mode of thought unconsciously, and as the result of his own experience, while the latter uses it as a result of direct precept. It cannot be denied that the latter has the great advantage of saving in time and useless experiment.

Human efficiency is just as much susceptible to scientific analysis as is the operation of a machine. The efficiency of the electric dynamo, for example, has been brought to an astonishingly high degree of perfection by the simple process of analyzing every element entering into its construction, and determining by experiment the condition under which that element would contribute the highest result to the total output. The most complicated and wonderful of all machines is the human mind, and we are but just beginning to apply the same methods of scientific analysis and education to this mechanism that has resulted in the tremendous progress in material machinery within the past two centuries. This science of the mind is called psychology, a word which, under the old scholasticism, implied nothing but comparatively useless speculation, but which in its present use signifies an application of the scientific method to the mind, has become one of the most vitally important and fruitful fields of all scientific research.

Of the several proficient scholars and able writers on this new science, Professor Scott holds a leading position. His writing is entirely free from the vague speculations with which this subject has been so frequently clouded, and is as clear and direct as any discussion of strictly material scientific questions. The present volume is one which will not only give a solid foundation for success in business, but will prove a source of inspiration as well. The young man—and, indeed, not a few of the older and more experienced —who can read this book without receiving a powerful stimulus for well-directed effort, as well as principles for his guidance, has not the stuff in him of which the successful business man is made.

MACHINE SHOP LIGHTING, by C. E. Clewell; *American Machinist.*

Under this title the author, who is the lighting specialist of the Westinghouse Electric & Manufacturing Company, contributes a series of articles to the *American Machinist,* beginning with the issue of March 30, 1911, and continuing in the issues of April 13, June 8, August 24 and October 26.

The first article deals with the "Practical Requirements of Machine Shop Lighting," and divides the subject into three general heads, viz., (a) General Overhead Illumination, (b) Specific Illumination by the Use of Individual Lamps Close to the Work, (c) A Combination of the Two, and goes into the details of the wiring and installation plans necessary for these three systems.

The second article deals with the "Illumination of Drafting Rooms." The indirect method of lighting is discussed in detail and scale drawings of home-made units for this purpose are given.

The third article takes up the subject of "Foundry Lighting," and discusses the various difficulties encountered in this problem, and shows successful results obtained by the use of Cooper Hewitt and tungsten installations.

The fourth article is entitled "Shop Lighting Design," and deals with the strictly engineering problems connected with factory illumination, reference being made to numerous diagrams and illustrations.

In the fifth article the subject of "Shop Lighting Installation" is treated in the careful analytical manner characteristic of the author's work, use being made of ample diagrams and half-tones to illustrate the matter.

Altogether this series of articles em-

bodies the most complete treatment of this phase of industrial lighting that has yet appeared. The author's wide experience in the subject with which he deals, as well as his engineering skill, give a distinct value to the articles that is not always found in contributions to the subject that appear in the trade and technical press.

LIGHTING THE PANAMA CANAL; *Elec. Wld.*, December 23.

INAUGURATION OF "WHITE WAY" IN NEW HAVEN; *Elec. Wld.*, December 23.

PABST THEATER, MILWAUKEE; *Elec. Wld.*, December 23.

THE EFFECT OF FROSTED LAMP TIPS ON LIGHT DISTRIBUTION, by Albert Scheible; *Elec. Wld.*, December 30.

The writer states that the use of so-called bowl frosted lamps, with either prismatic or opal reflectors, produces a greater change in the distribution curve than is generally supposed; in evidence of which he shows two curves giving the distribution of light with a 60-watt clear bulb tungsten lamp in a bowl-shaped reflector, and a bowl frosted lamp used under the same conditions. A curve of horizontal illumination, resulting from the two distributions, is also given.

VISUAL ACUITY, by J. P. Wintringham; *Elec. Wld.*, December 30.

ORNAMENTAL SCROLL BRACKET LAMP-POST FOR NEW YORK; *Elec. Wld.*, January 6.

NOTES ON DIFFUSION OF LIGHT, by J. R. Cravath; *Elec. Wld.*, January 13.

This article is the result of investigations carried out by the writer to determine under what conditions annoying glare from a reading page of ordinary glazed paper may be present, and under what conditions it is least. The pages of the *Electrical World* were taken for the experiment. Attention is called to the fact that glare from regular reflection from polished surfaces such as paper or metals is perhaps even more responsible for eye-strain than glare received direct from uncovered light-sources. Furthermore, it is easier to avoid the latter than the former, an inclination of the head or changing position of the eyes frequently being all that is necessary. The method of conducting the experiments and the results are carefully given, from which the following conclusions are drawn:

(1) The greater the proporton of light received on the paper from a single source the more pronounced the glare.

(2) The glare from a bare lamp without reflector is usually more annoying than for the same lamp equipped with a reflector.

(3) When the paper is tilted at proper angle direct lighting from one source of light is as satisfactory as indirect as far as the quality of light on the paper is concerned, but this applies only where the paper and any surrounding surfaces from which glare may be received are under the control of the reader.

(4) If a reader is receiving glare from the paper, less movement or tilting of the paper is required to avoid glare from exposed or direct light-sources than with indirect lighting, but the glare is much more pronounced in the former case.

(5) Glare from paper with frosted-tip lamps as compared to a clear lamp is so nearly the same that there is no practical difference in the annoyance caused, the lamp being equipped with a reflector in both cases.

(6) In general, the sharpness and amount of shadow which can be obtained at any point in a room are a good indication of the amount of annoying glare which can be received from paper at certain angles in the same position. As sharp shadows are undesirable in themselves, this indicates that for general office and work room lighting the illumination should be designed to give as little sharp shadow as possible.

(7) The foregoing conclusions indicate that for large office and factory rooms it is best to spread out the source of illumination as evenly as possible. If a direct lighting system is used, this means that we should employ small units a short distance apart rather than large units at infrequent intervals. If indirect lighting is used, the more evenly the illumination is spread over the ceiling the better the results are likely to be.

ILLUMINATION OF ST. PATRICK'S CATHEDRAL IN HONOR OF CARDINAL FARLEY; *Elec. Wld.*, January 20.

SOME FACTORS IN HETEROCHROMATIC PHOTOMETRY, by Louis Bell; *Elec. Wld.*, January 27.

This is a strictly technical article on a subject upon which the writer is an authority. The purpose of the article is to call attention to a source of error in color photometry to which comparatively little

attention has been paid. This is the direct effect of simultaneous contrast in modifying the apparent luminosities of two colored lights under comparison.

The writer discusses the theory of the subject, and reports upon experiments conducted. The conclusion drawn is that the flicker photometer is the only form in which simultaneous contrast is fully eliminated. The article is a valuable addition to the technical literature on this subject.

ILLUMINATION OF TEXTILE MILLS, by John Calder; *Elec. Wld.,* January 27.

THE HISTORY OF ORNAMENTAL LAMP-POSTS, by Manfred A. Pakas; *Electrical Review and Western Electrician,* January 6.

PROGRESS IN ARC LAMPS AND ILLUMINATION, by C. E. Clewell; *Elec. Journal,* January.

DEVELOPMENTS IN ILLUMINATION AND IN THE MANUFACTURE OF INCANDESCENT LAMPS, by Norman Macbeth; *Elec. Journal,* January.

ELECTRIC SIGN DEVELOPMENT THROUGHOUT THE SOUTH, by J. E. Tucker; *Southern Elecn.,* January.

MAZDA DRAWN WIRE FILAMENT LAMPS, by C. W. Bender; *Railway Electrical Engineer,* January.

THE BEST SIGN LIGHTED CITY IN THE WORLD; *Selling Electricity,* January.

LUMINOMETERS VS. MUNICIPAL OWNERSHIP, by Glenn Marston; *Selling Electricity,* January.

A VILLAGE ENTERTAINMENT TO BUY STREET LIGHTING; *Selling Electricity,* January.

DECORATIVE STREET LIGHTING SUPPLEMENT; *Selling Electricity,* January.

STREET LIGHTING, by E. L. Elliott; *Electric City Magazine,* January.

SIGNIFICANCE OF ORIGINALITY IN MODERN GAS LIGHTING (Numbers 1, 2 and 3), by F. L. Godinez; *Progressive Age,* Jan. 1, Jan. 15 and Feb. 1.

DECKED WINDOW LIGHTING, by R. M. Thompson; *Progressive Age,* Jan. 1.

OUTSIDE ILLUMINATION, by W. H. Rankin; *Progressive Age,* February 1.

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